ERRATA

1. VOLUME I: Page 222 (Fig. 209) is missing
(Email JC Turner to get this page).

2. VOLUME IV. At the end of Appendix 2009 (see heading CWH KNOTS) there are three pages numbered 197, i and ii.
Disgard these three pages, as they do not belong in the book.

THE BRAIDER

VOLUME IV

ALBERTUS GEORG SCHAAKE

THE BRAIDER

VOLUME IV : Issue Numbers 46–60

ALBERTUS GEORG SCHAAKE

— May 2006 to November 2009

PREFACE

This is the final of four volumes on the Theory and Practice of Braiding. It brings together the last fifteen issues of a Journal called simply *THE BRAIDER*.

Albertus Georg Schaake was born in Holland in 1933. He studied Engineering at Delft Technical University, before emigrating to New Zealand in 1962. His career has been spent first as a Public Works Engineer, and then as a Tutor in Engineering subjects at the Waikato Polytechnic in Hamilton.

For the last thirty years he has devoted countless hours to the study and practice of braiding : to the creation of decorative braids in particular. Towards the end of the 1980s, he began a project to publish his discoveries, occasionally collaborating with other authors, to produce a stream of books, pamphlets, articles and research papers on a variety of topics in braiding theory. These publications range from books on Regular Knots, Fiador Knots and Herringbone Knots through to extensive pamphlets on the braiding of Wheelknots. For a lengthy account of the progress and philosophy of this work up to 1995, the reader is referred to chapter twelve of *History and Science of Knots* edited by J C Turner and P van de Griend, and published by World Scientific (1995).

In 1995, such was the large output of Schaake's ideas on the subject, that he decided to produce a quarterly Journal which would summarize and extend the description of his work. He called the Journal *The Braider*; and in the next eleven years, virtually single-handedly, he produced 60 issues. Such was his industry and application, that when he stopped his researches, due to illness in 2006, he had already prepared quarterly issues which would take the series up to November 2009.

In total, some 1600 pages of ideas, philosophies, theories, and instruction on design and production of decorative braids, have flowed from his computer and have been included in the issues of *The Braider*. In all the issues there are numerous diagrams which illustrate the theories and techniques. All of these were produced by Schaake by means of a computer-aided design package.

Now, in 2007, it is my privilege to bring together all sixty of the issues, unchanged and unedited, into a collection of four spirally-bound Volumes. They will be available for future generations of braiders to study and further the great body of work that Schaake has initiated.

Georg Schaake may truly be said to be the father of Modern Braiding Theory; very little of consequence existed before he began his researches.

The four-volume collection may be taken as a text for all braiders, from beginners to the most advanced. It is essential reading for all serious decorative braiders.

John C. Turner,
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New Zealand (August, 2007).
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for
the braiding artisan

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Solution to the question in Issue No. 45

Question on pg. 1068.

In general only two essential strings are required in an A-pass Standard Herringbone Grant Knot when the following two conditions are fulfilled:

1. There should only be two first-return string-runs.
2. Let the first-return string-run cover a distance of N nests. Then $\text{g.c.d.}(N, B^*) = 1$.

The number of nests N covered by a first-return string-run of a Standard Herringbone Grant Knot can readily be calculated from its associated Standard Herringbone Pineapple Knot. Let the associated Standard Herringbone Pineapple Knot have the half-cycle $1 \longrightarrow k$ from lower-left to upper-right. Then $x = 2k + 2 + A(2n-1)$, where n is a whole number, in the associated Standard Herringbone Pineapple Knot.† Let in a first-return string-run the number of half-cycles associated with the associated Standard Herringbone Pineapple Knot be equal to H. Then:

$$N = \frac{Hx + 4HA - 2\sum(l_i + r_i)}{2A} \,.\ ‡$$

For the string-run of the associated Standard Herringbone Pineapple Knot with $A = 5$ and $k = 4$ Fig. 826 shows the four sets of the two first-return string-runs with their associated Standard Herringbone Pineapple Knot half-cycles.

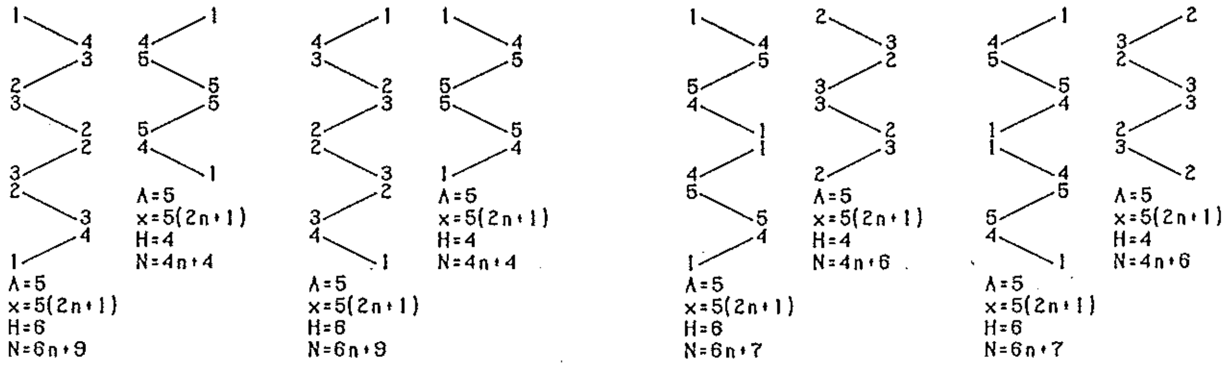


Fig. 826 — The sets of two first-return string-runs with their associated Standard Herringbone Pineapple Knot half-cycles.

The left two sets as well as the right two sets of the two first-return string-runs are each others mirror-image. Note that in the right two sets the first-return string-runs with $H = 6$ are identical.

The left two sets require that $\text{g.c.d.}(N, B^*) = 1$, hence $B^* = 7, 11, 13, 17, 19, \cdots$ for $n = 1$ and $B^* = 5, 11, 13, 17, 19, \cdots$ for $n = 2$.

The right two sets require that $\text{g.c.d.}(N, B^*) = 1$, hence $B^* = 3, 7, 9, 11, 17, 19, \cdots$ for $n = 1$ and $B^* = 3, 5, 9, 11, 13, 15, 17, \cdots$ for $n = 2$.

Only the right two sets give us a symmetric colour-pattern. They are shown in Fig. 827 for $n = 2$ (hence $x_{\text{Pineapple}} = 25$) and $B^* = 5$.

---

† See *The Braider*, Issue No. 23, pg. 521.

‡ Note that $N = P_c$ for the component associated with a first-return string-run in the Standard Herringbone Grant Knot ($H = 2\alpha$ and $Hx_{\text{Pineapple}} + 4HA - 2\sum(l_i + r_i) = 2\left[\alpha x_{\text{Grant}} + \sum(\Delta_{l_i} + \Delta_{r_i})\right]$, while $A^{**} = A$ and $B^{**} = B^*$. See *The Braider*, Issue No. 19, pg. 417 and Issue No. 23, pg. 532.).

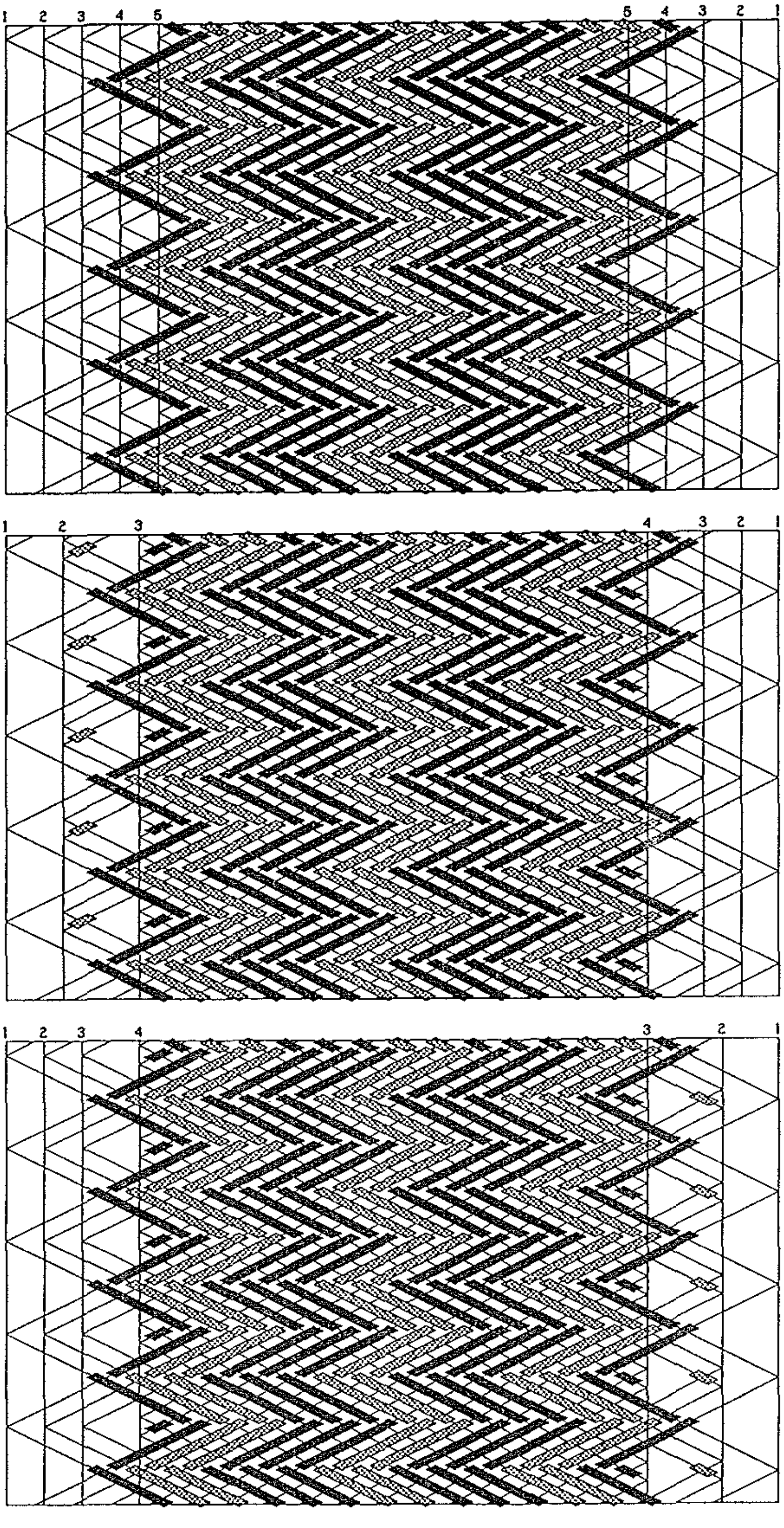


Fig. 827 — A two string Standard Herringbone Grant Knot with $A = 5$, $B^* = 5$, $x = 27$ and symmetric colour-pattern.

For two essential strings in general, the sets of the two first-return string-runs are shown in Figs. 828, 829, 830, 831, 832. Each of these sets has a mirror-imaged set; the right-hand set in Fig. 830 and the left-hand set in Fig. 831 are identical to their respective mirror-image. Note that for $k = A$ the right-hand set in Fig. 828 and that for $k = 2$ the right-hand set in Fig. 829 each reduce to one first-return string-run, in which case g.c.d.$(N, B^*) = 2$ is required for two essential strings.

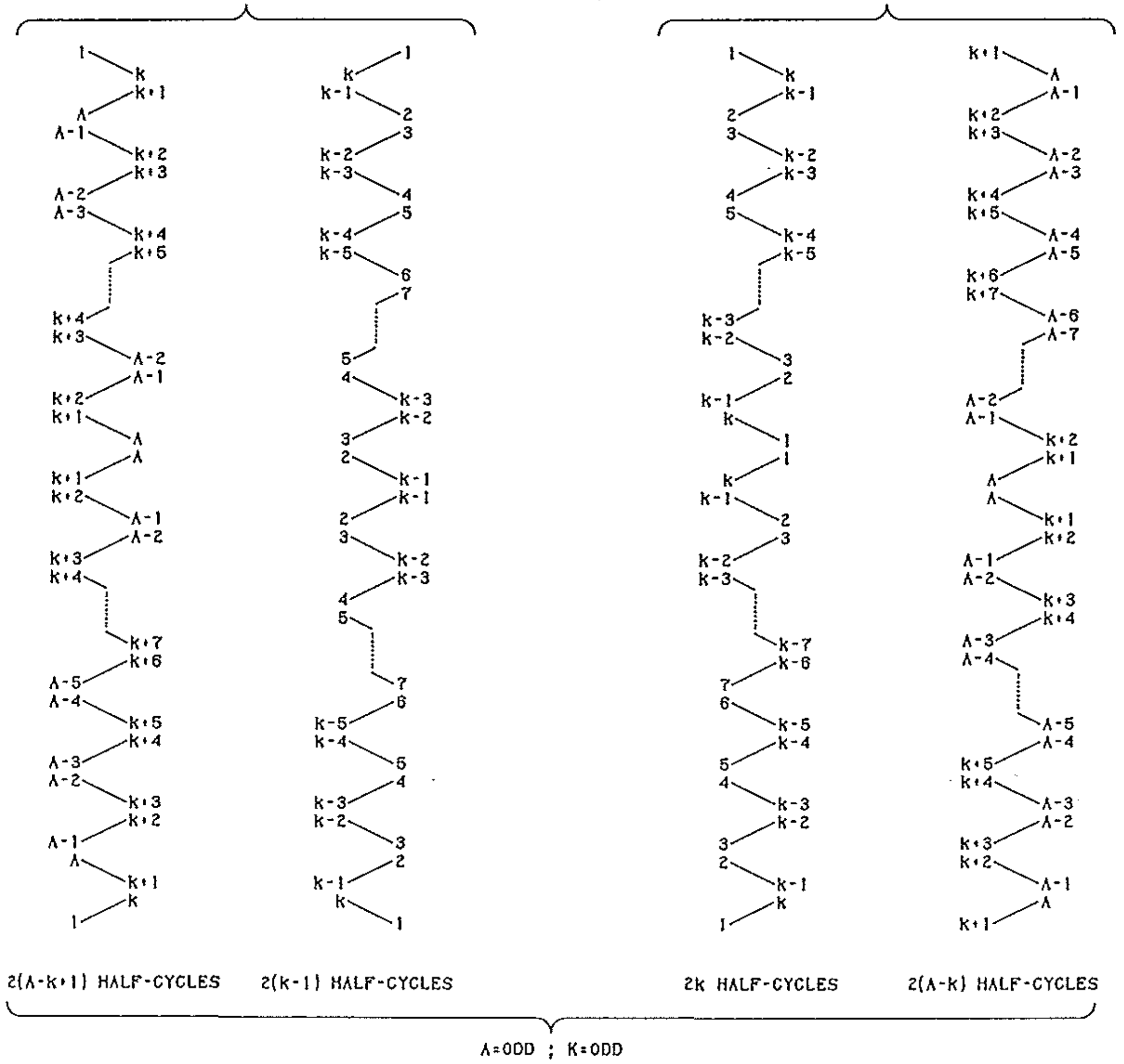
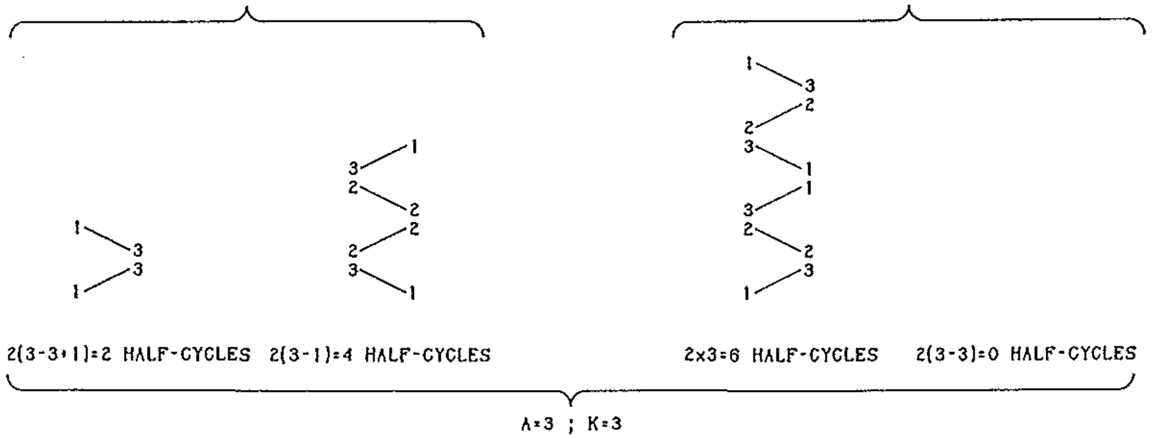


Fig. 828 — A=odd, k=odd.

Example:



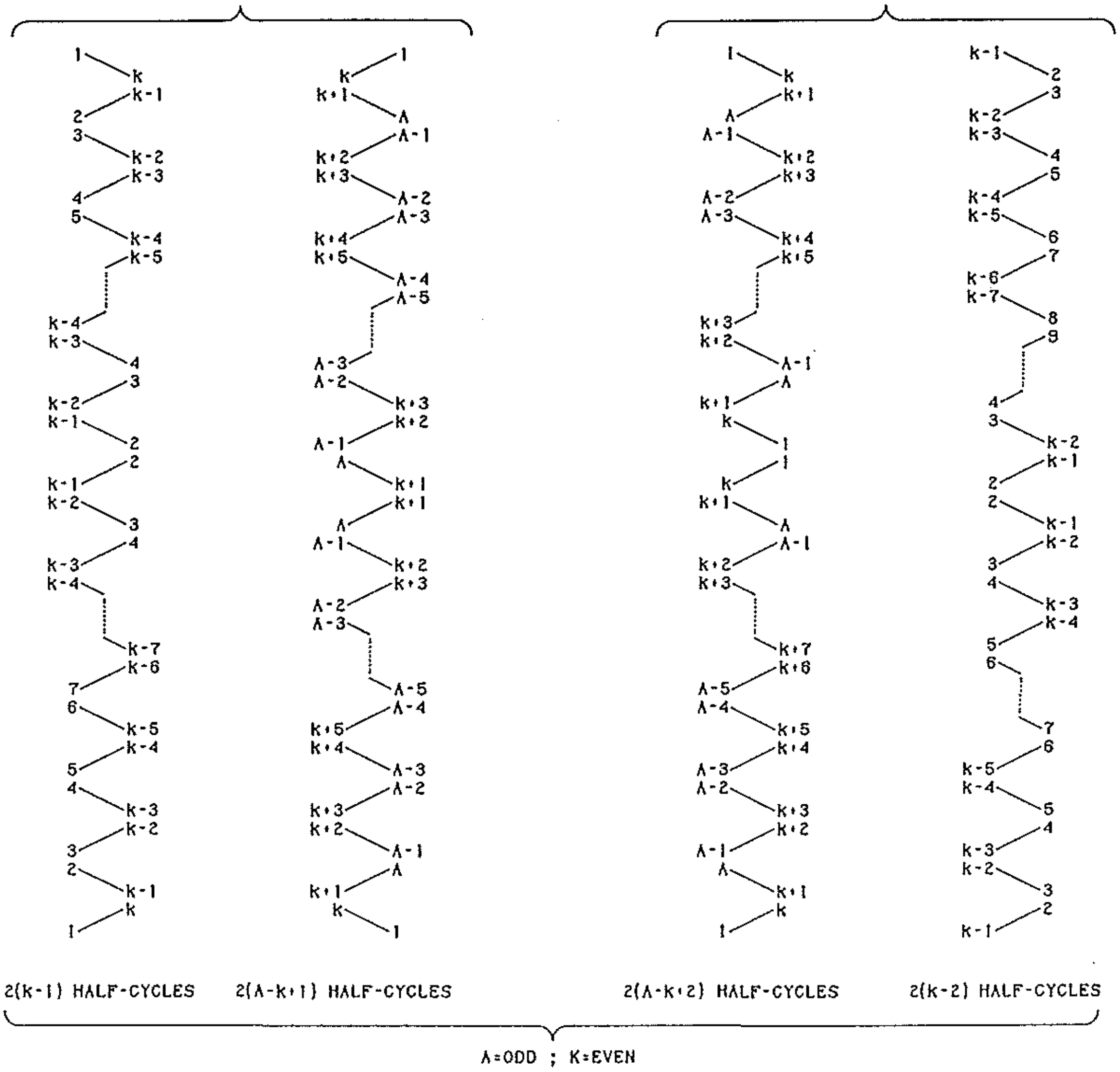
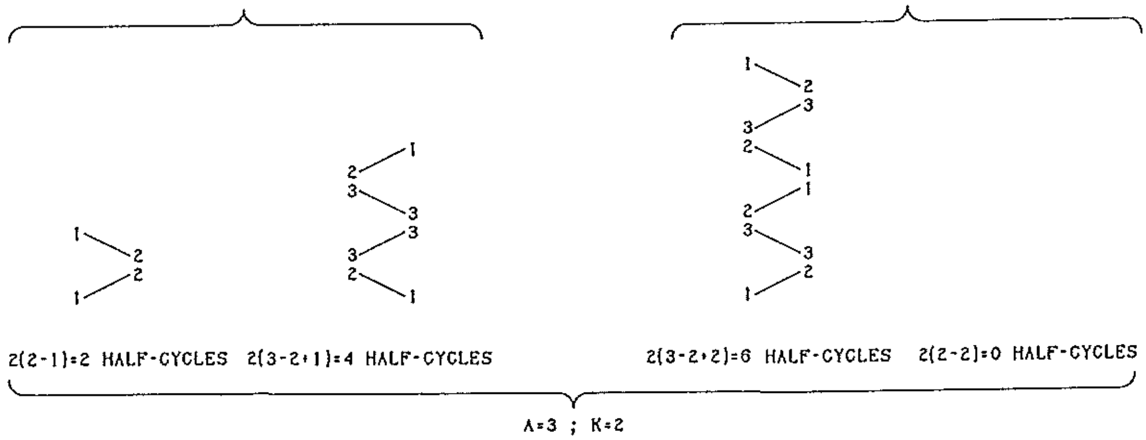


Fig. 829 — A=odd, k=even.

Example:



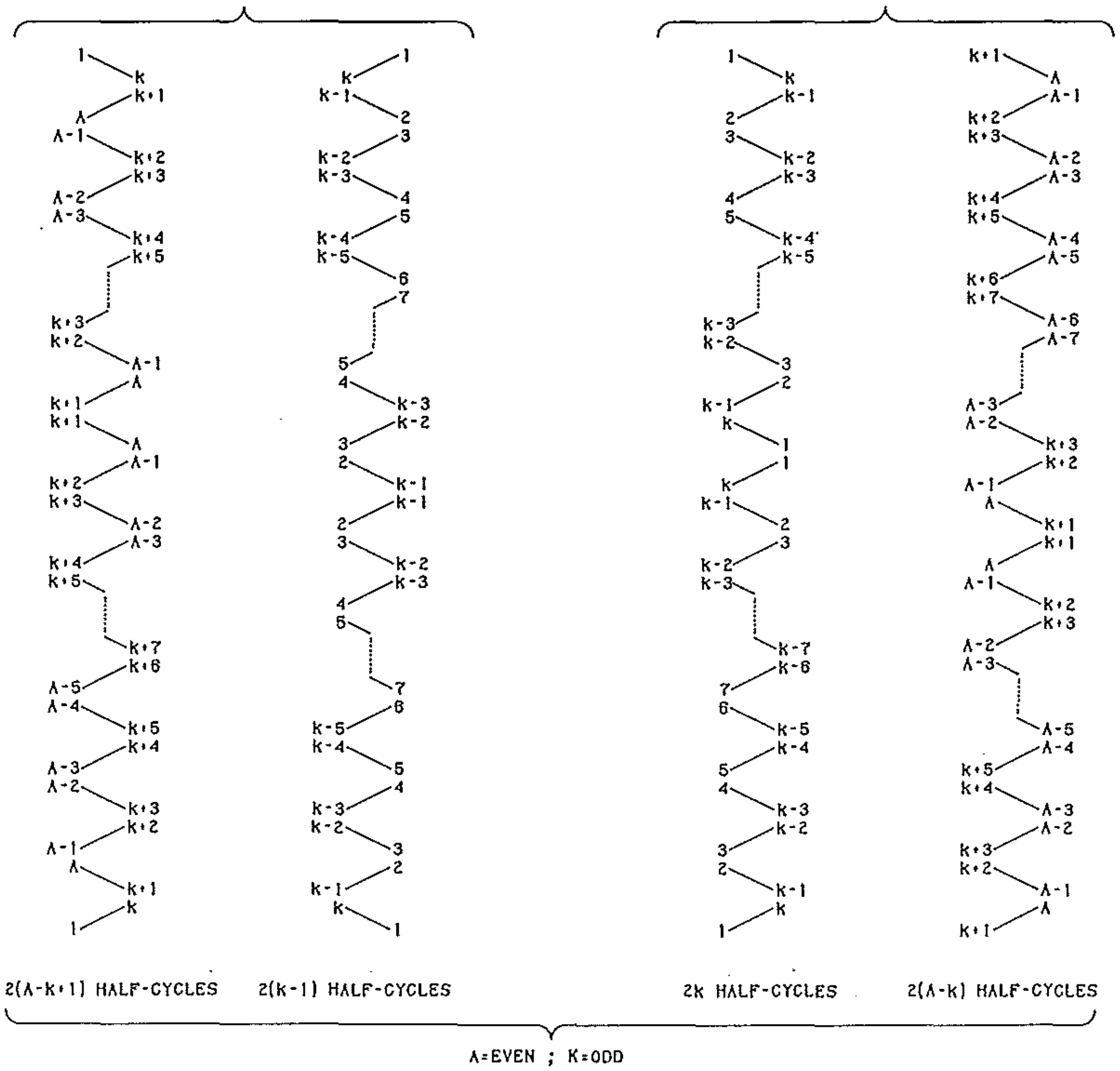
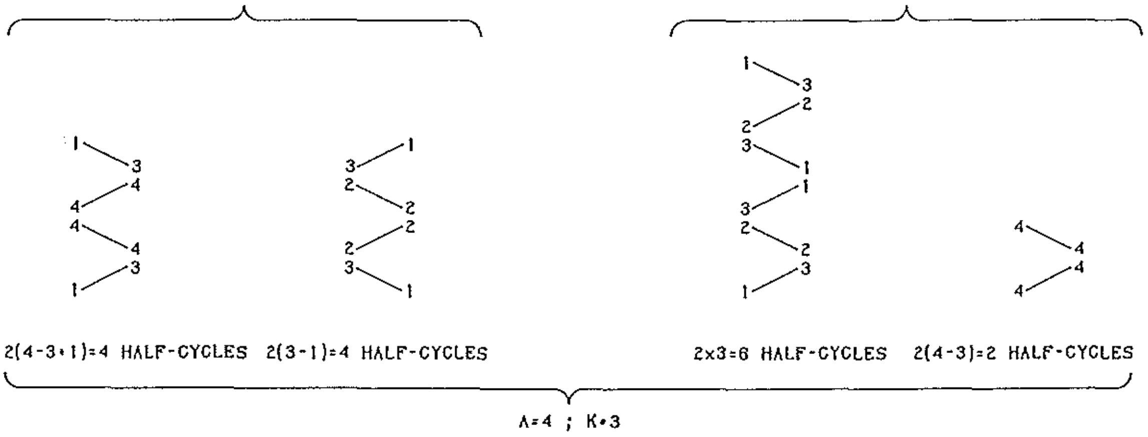


Fig. 830 — A=even, k=odd.

Example:



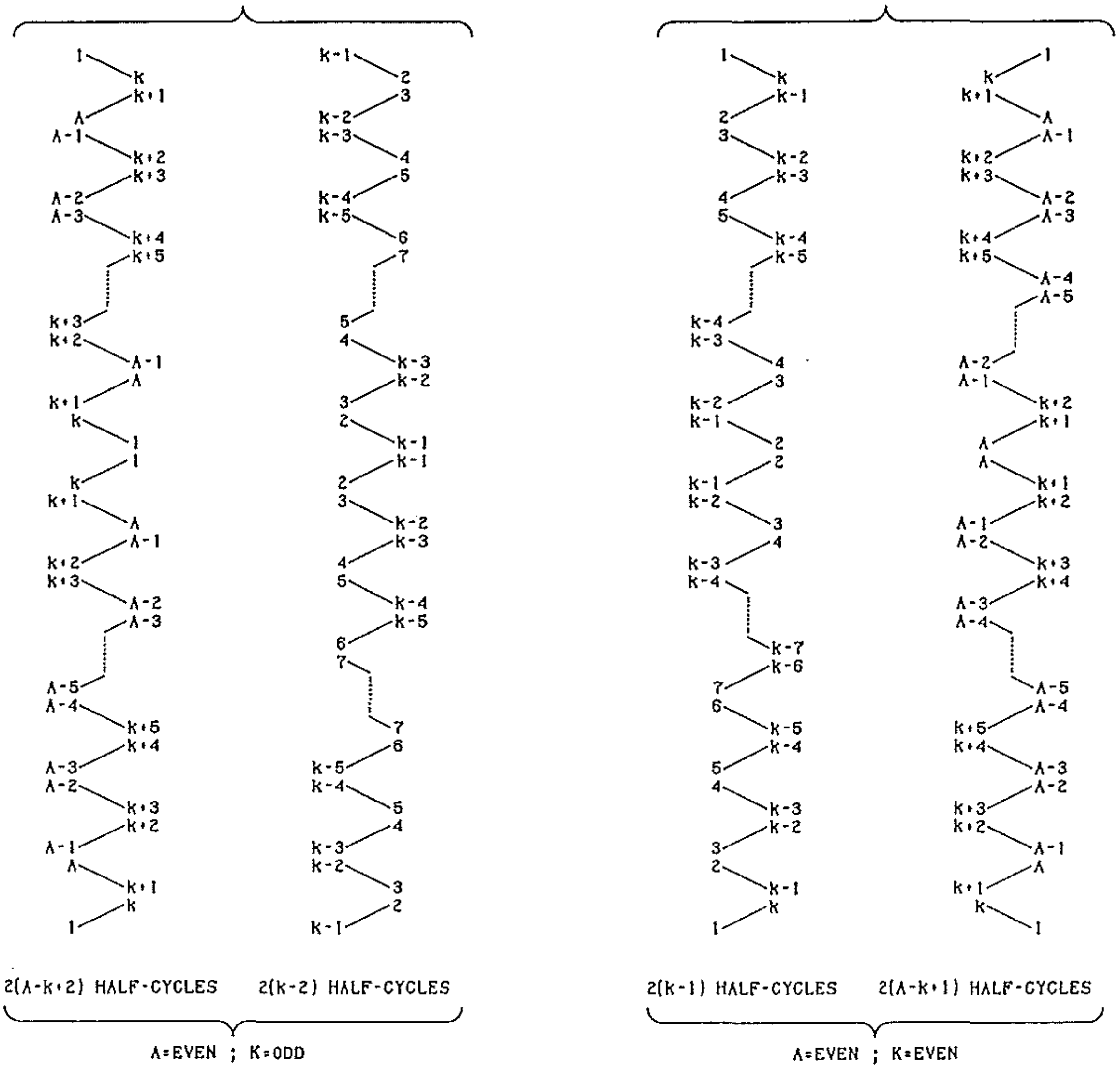
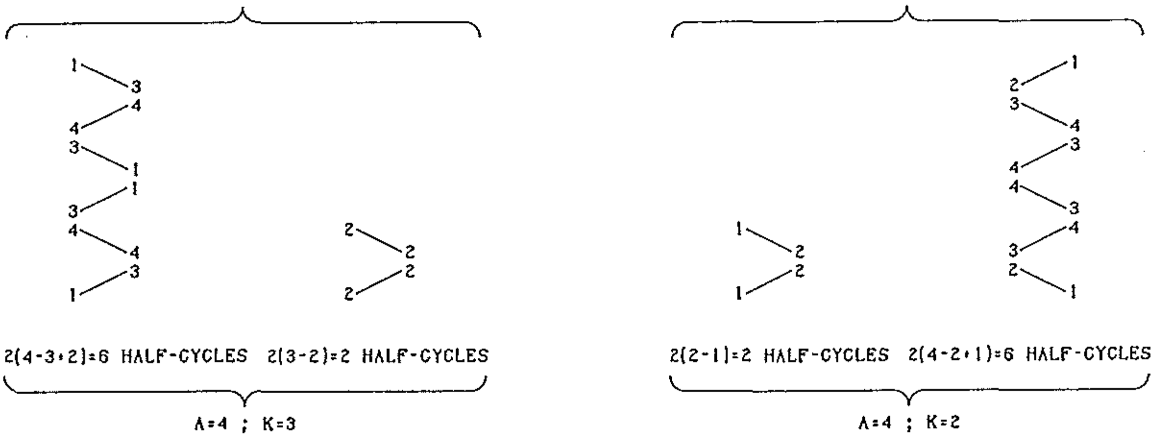


Fig. 831 — A=even , k=odd and A=even , k=even.

Example :



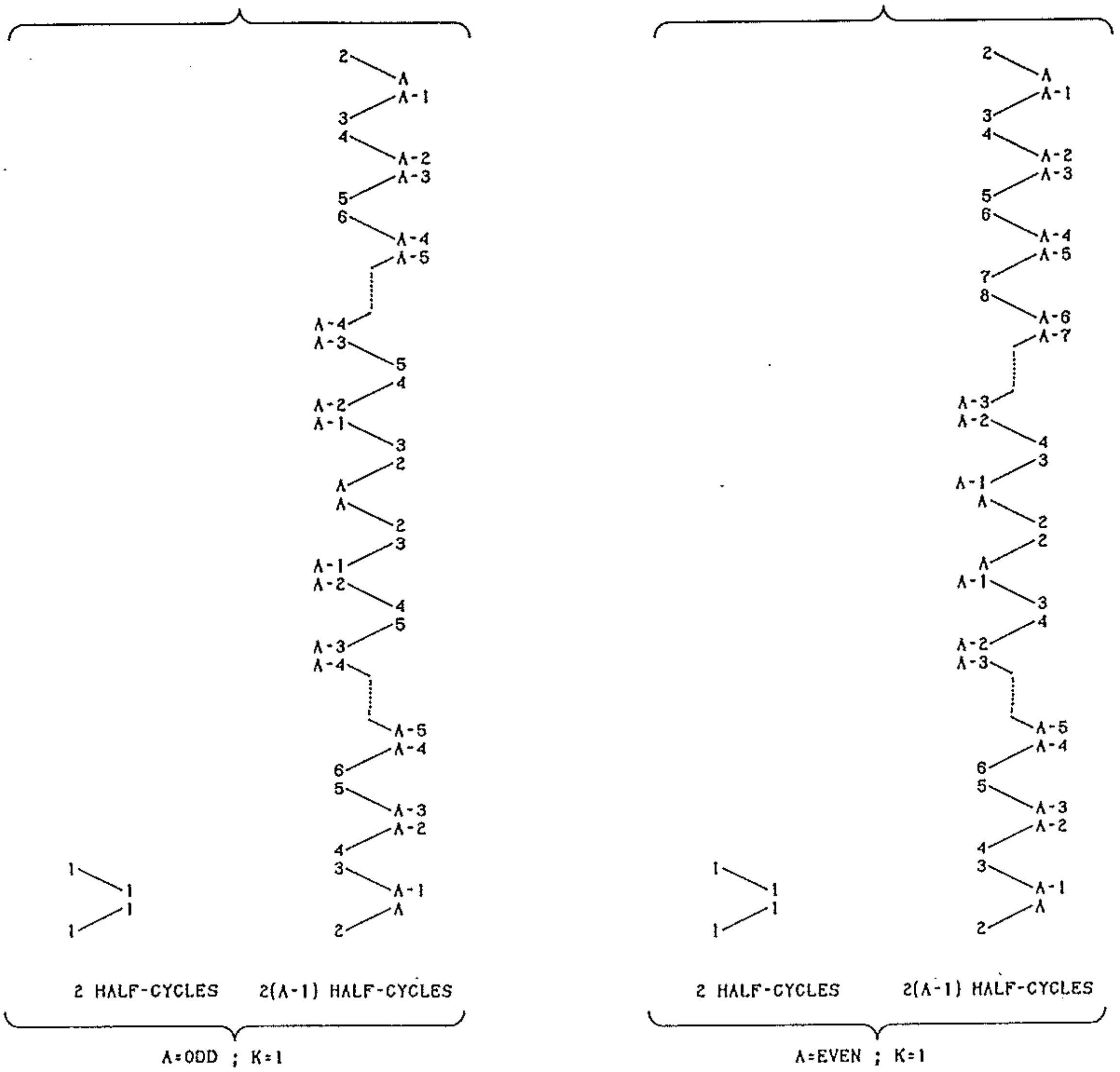
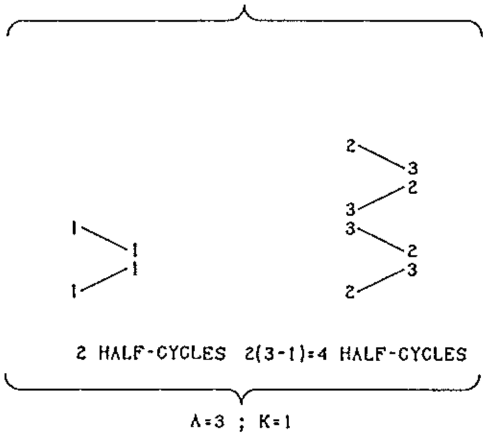
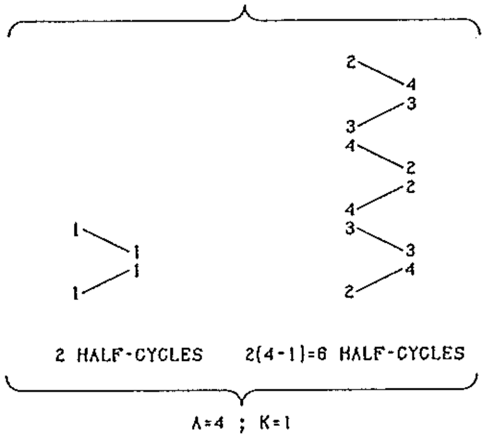


Fig. 832 — A=odd, k=1 and A=even, k=1.

Example:





Grant Knots

On pg. 1066 we have seen that the string-runs of **Standard Herringbone Grant Knots** are characterised by $y = A$. To be more explicit:

The string-run of a **Standard Herringbone Grant Knot** is characterised by $y = A$ and the total number of essential strings equals the total number of components (hence equals the number of first-return string-runs, thus when $\text{g.c.d.}(P_c, B^*) = 1$ for each component).

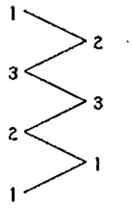
The string-run of a **Semi-Standard Herringbone Grant Knot** is characterised by $y = A$ and the total number of essential strings is greater than the total number of components (hence greater than the number of first-return string-runs, thus when for at least one component $\text{g.c.d.}(P_c, B^*) \neq 1$).

Note that the string-run of a Standard or Semi-Standard Herringbone Grant Knot can consist of one component when $A = odd$ (see pg. 1079), then $P_c = P_{total}$.

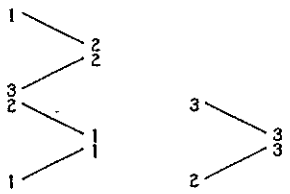
The string-run of a **Perfect Herringbone Grant Knot** is characterised by $y = A - 1$ or $y = A + 1$ and the total number of essential strings equals the total number of components (hence equals the number of first-return string-runs, thus when $\text{g.c.d.}(P_c, B^*) = 1$ for each component).

The string-run of a **Semi-Perfect Herringbone Grant Knot** is characterised by $y = A$ or $y = A + 1$ and the total number of essential strings is greater than the total number of components (hence greater than the number of first-return string-runs, thus when for at least one component $\text{g.c.d.}(P_c, B^*) \neq 1$).

In *The Braider*, Issue No. 23, pg. 531 we have already met a Perfect Herringbone Grant Knot which was derived from, and hence associated with, a Semi-Perfect Herringbone Pineapple Knot. The first-return string-run of this Herringbone Pineapple Knot is shown at the left below, and since $B^* = 3$ with $P = 2A + x - 2 = 18$, $\text{g.c.d.}(P_c, B^*) = 3$, hence $\neq 1$, this Herringbone Pineapple Knot with $y = A + 1$ is a Semi-Perfect Herringbone Pineapple Knot (it requires three essential strings).



$A=3,\ x=14,\ y=A+1$



$A=3,\ x=14,\ y=A+1.\ \ x_{GRANT}=15.$

For the Perfect Herringbone Grant Knot (with $x = 15$), the two first-return string-runs associated with its associated Semi-Perfect Herringbone Pineapple Knot are shown at right. The leftmost one of these two first-return string-runs has $A = 3$, $x = 14$, $H = 4$, $\sum(l_i + r_i) = 7 + 6 = 13$; hence $N = \frac{Hx + 4HA - 2\sum(l_i + r_i)}{2A} = 13 = P_c$. For the rightmost one of these two first-return string-runs we have $A = 3$, $x = 14$, $H = 2$, $\sum(l_i + r_i) = 5 + 6 = 11$; hence $N = \frac{Hx + 4HA - 2\sum(l_i + r_i)}{2A} = 5 = P_c$. Since $\text{g.c.d.}(N, B^*) = \text{g.c.d.}(13, 3) = 1$ and $\text{g.c.d.}(N, B^*) = \text{g.c.d.}(5, 3) = 1$, the Perfect Herringbone Grant Knot requires two essential strings.

There is no symmetry in the colour-pattern, although it has orientation and balance. However, in general we desire Perfect and Semi-Perfect Herringbone Grant Knots with either symmetry in the colour-pattern or with a better balanced one. A few of the following examples will show that this can readily be achieved.

Example 1:

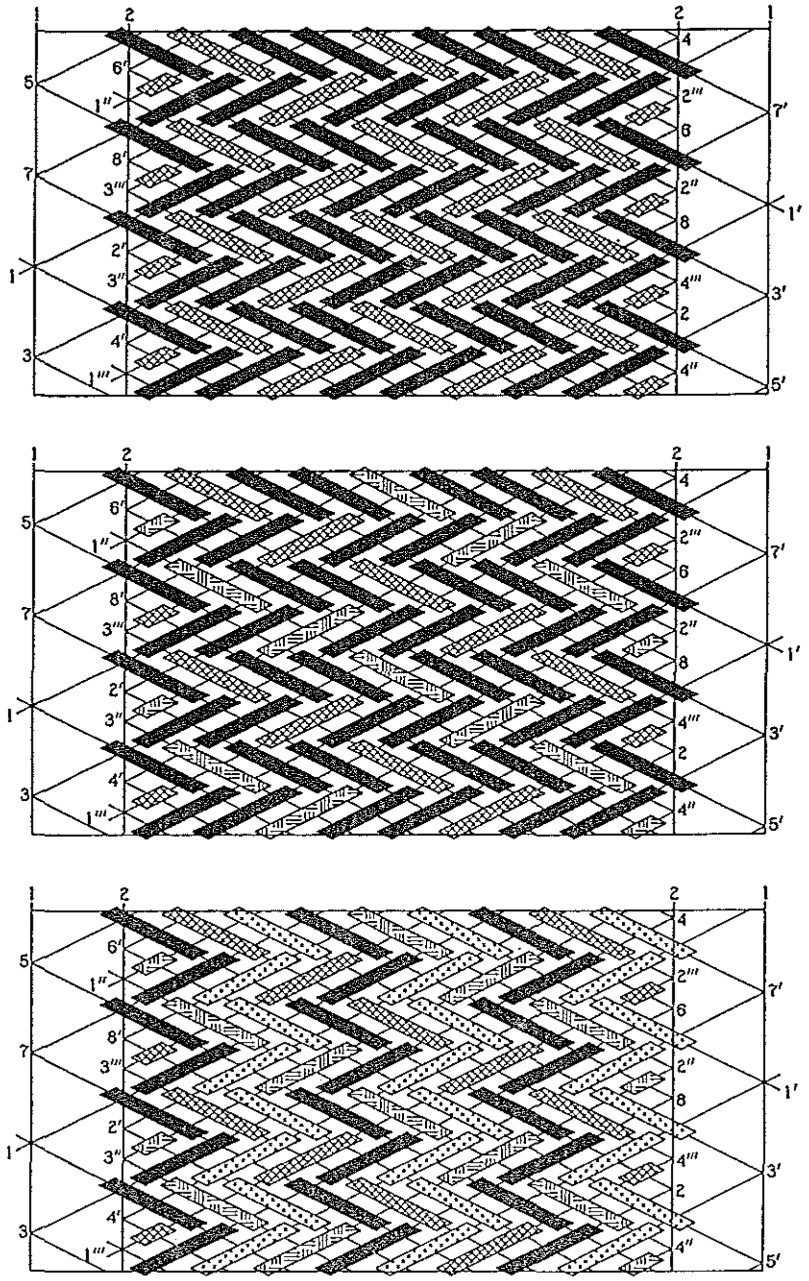
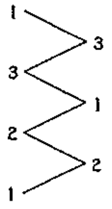
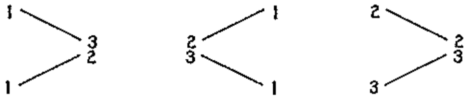


Fig. 833 — Different colour-patterns for identical string-runs.

For the Semi-Perfect Herringbone Grant Knots in Fig. 833 (with $x = 18$), the three first-return string-runs associated with their associated Semi-Perfect Herringbone Pineapple Knot are shown below at right.



$\Lambda=3,\ x=16,\ y=\Lambda+1$



$\Lambda=3,\ x=16,\ y=\Lambda+1.\ x_{count}=18.$

For the leftmost one of these three first-return string-runs we have $A = 3$, $x = 16$, $H = 2$, $\sum(l_i + r_i) = 2 + 5 = 7$; hence $N = \frac{Hx+4HA-2\sum(l_i+r_i)}{2A} = 7 = P_c$. For the next first-return string-run to the right we have $A = 3$, $x = 16$, $H = 2$, $\sum(l_i + r_i) = 5 + 2 = 7$; hence $N = \frac{Hx+4HA-2\sum(l_i+r_i)}{2A} = 7 = P_c$. For the rightmost one of these three first-return string-runs we have $A = 3$, $x = 16$, $H = 2$, $\sum(l_i + r_i) = 5 + 5 = 10$; hence $N = \frac{Hx+4HA-2\sum(l_i+r_i)}{2A} = 6 = P_c$. Since g.c.d.$(N, B^*) =$ g.c.d.$(7, 4) = 1$, g.c.d.$(N, B^*) =$ g.c.d.$(7, 4) = 1$ and g.c.d.$(N, B^*) =$ g.c.d.$(6, 4) = 2$, the Semi-Perfect Herringbone Grant Knot requires four essential strings.

Example 2:

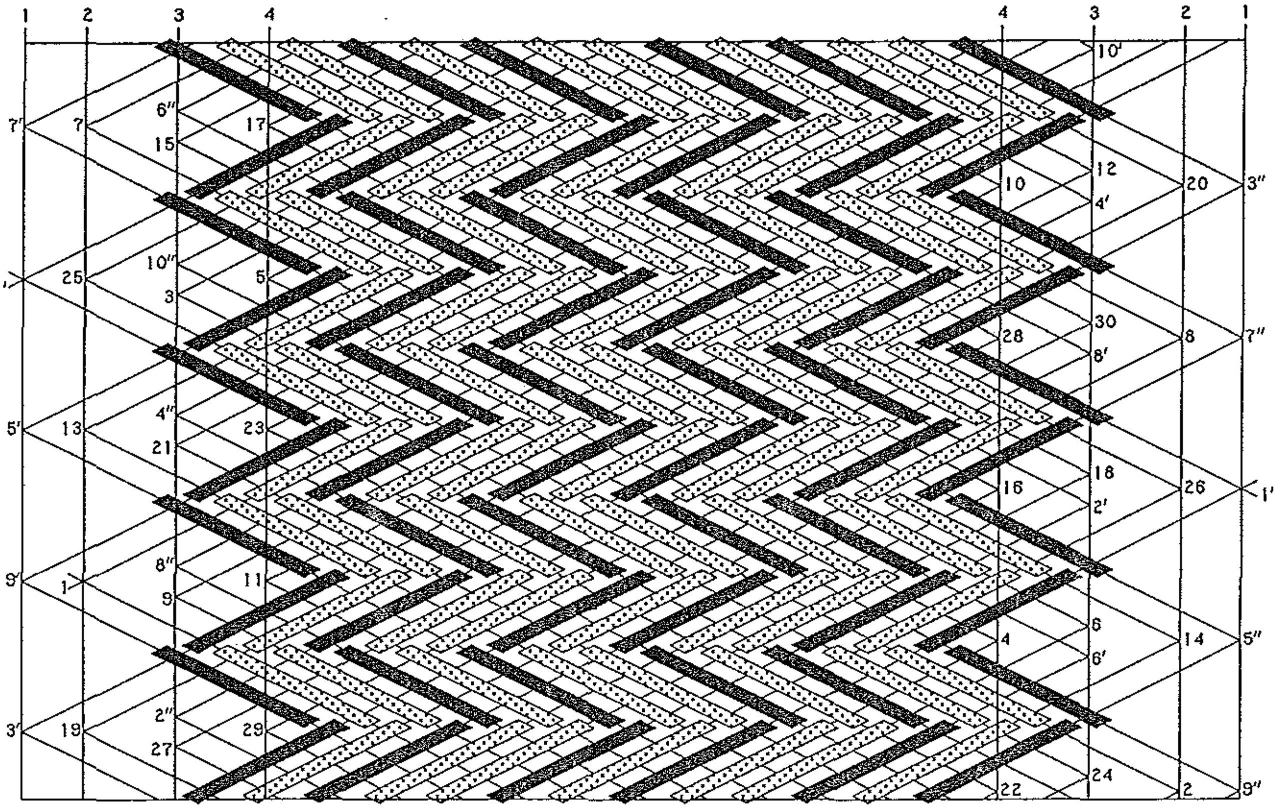
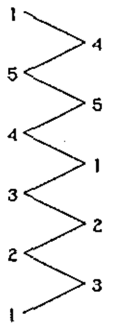
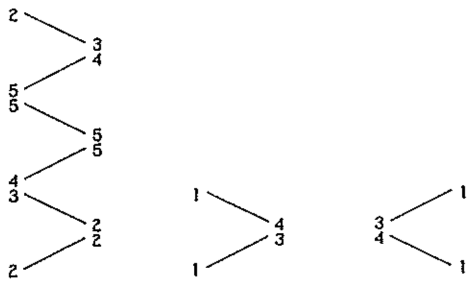


Fig. 834 — $A = 5$, $B^* = 5$, $x = 24$, $y = 6$.

For the Perfect Herringbone Grant Knots in Fig. 834 and the Semi-Perfect Herringbone Grant Knot in Fig. 835 (both with $x = 24$), the three first-return string-runs associated with their associated respective Perfect and Semi-Perfect Herringbone Pineapple Knot are shown below at right.



A=5, x=24, y=A+1



A=5, x=24, y=A+1. x_{GRANT}=24.

For the leftmost one of these three first-return string-runs we have $A = 5$, $x = 24$, $H = 6$, $\sum(l_i + r_i) = 21 + 21 = 42$; hence $N = \frac{Hx+4HA-2\sum(l_i+r_i)}{2A} = 18 = P_c$. For the next first-return string-run to the right we have $A = 5$, $x = 24$, $H = 2$, $\sum(l_i + r_i) = 2 + 7 = 9$; hence $N = \frac{Hx+4HA-2\sum(l_i+r_i)}{2A} = 7 = P_c$. For the rightmost one of these three first-return string-runs we have $A = 5$, $x = 24$, $H = 2$, $\sum(l_i + r_i) = 7 + 2 = 9$; hence $N = \frac{Hx+4HA-2\sum(l_i+r_i)}{2A} = 7 = P_c$. Since for the Perfect Herringbone Grant Knot in Fig. 834 g.c.d.(N, B^*) = g.c.d.$(18, 5) = 1$, g.c.d.(N, B^*) = g.c.d.$(7, 5) = 1$ and g.c.d.(N, B^*) = g.c.d.$(7, 5) = 1$, this Perfect Herringbone Grant Knot requires three essential strings.

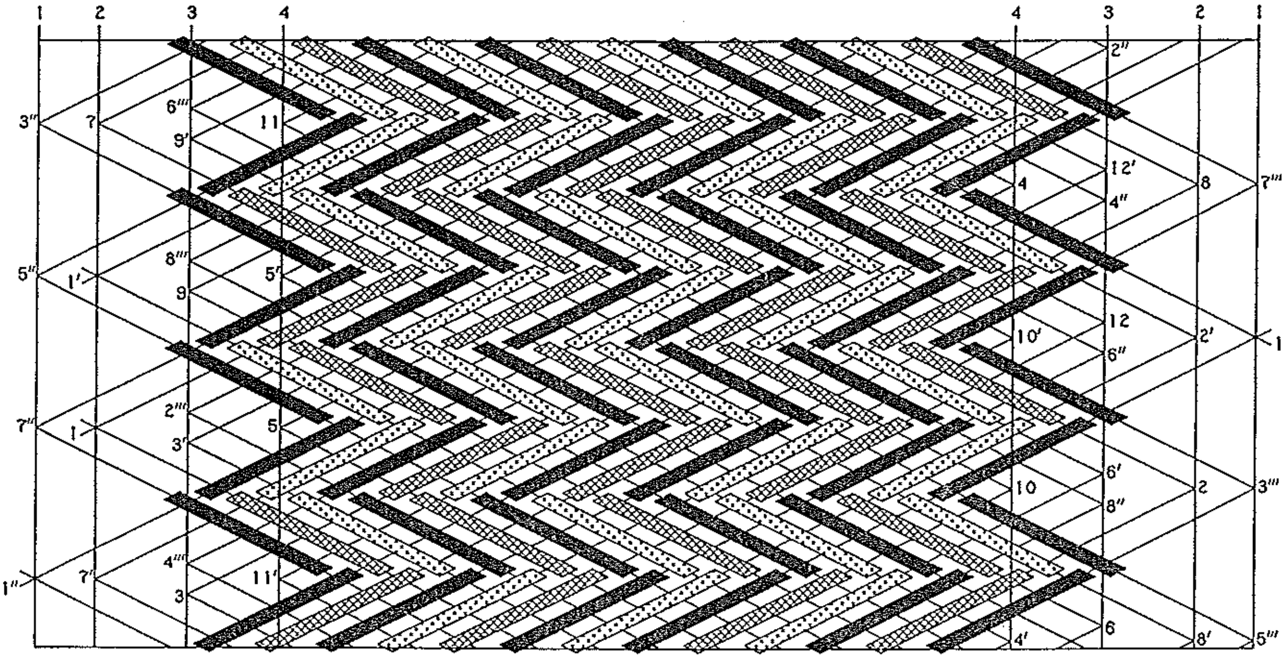
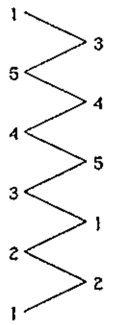


Fig. 835 — $A = 5$, $B^* = 4$, $x = 24$, $y = 6$.

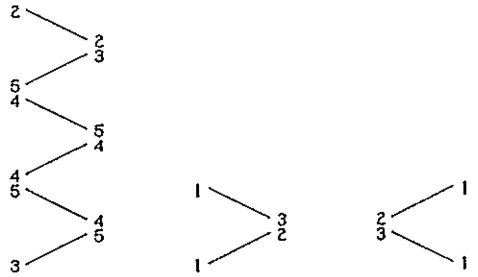
Since g.c.d.(N, B^*) = g.c.d.$(18, 4) = 2$, g.c.d.(N, B^*) = g.c.d.$(7, 4) = 1$ and g.c.d.(N, B^*) = g.c.d.$(7, 4) = 1$ for the Semi-Perfect Herringbone Grant Knot in Fig. 835, this Knot requires four essential strings.

Example 3:

For the Perfect Herringbone Grant Knot in Fig. 836 (with $x = 24$), the three first-return string-runs associated with their associated Semi-Perfect Herringbone Pineapple Knot are shown below at right.



A=5, x=22, y=A+1



A=5, x=22, y=A+1. x_{count}=24.

$A = 5$, $x = 22$, $H = 6$, $\sum(l_i + r_i) = 23{+}23 = 46$; thus $N = \frac{Hx+4HA-2\sum(l_i+r_i)}{2A} = 16 = P_c$ for the leftmost of these three first-return string-runs. $A = 5$, $x = 22$, $H = 2$, $\sum(l_i + r_i) = 2 + 5 = 7$; thus $N = \frac{Hx+4HA-2\sum(l_i+r_i)}{2A} = 7 = P_c$ for the next first-return string-run to the right. $A = 5$, $x = 22$, $H = 2$, $\sum(l_i + r_i) = 5 + 2 = 7$; thus $N = \frac{Hx+4HA-2\sum(l_i+r_i)}{2A} = 7 = P_c$ for the rightmost one of these three first-return string-runs. Since for the Perfect Herringbone Grant Knot in Fig. 836 g.c.d.$(N, B^*) =$ g.c.d.$(16, 5) = 1$, g.c.d.$(N, B^*) =$ g.c.d.$(7, 5) = 1$ and g.c.d.$(N, B^*) =$ g.c.d.$(7, 5) = 1$, this Perfect Herringbone Grant Knot requires three essential strings.

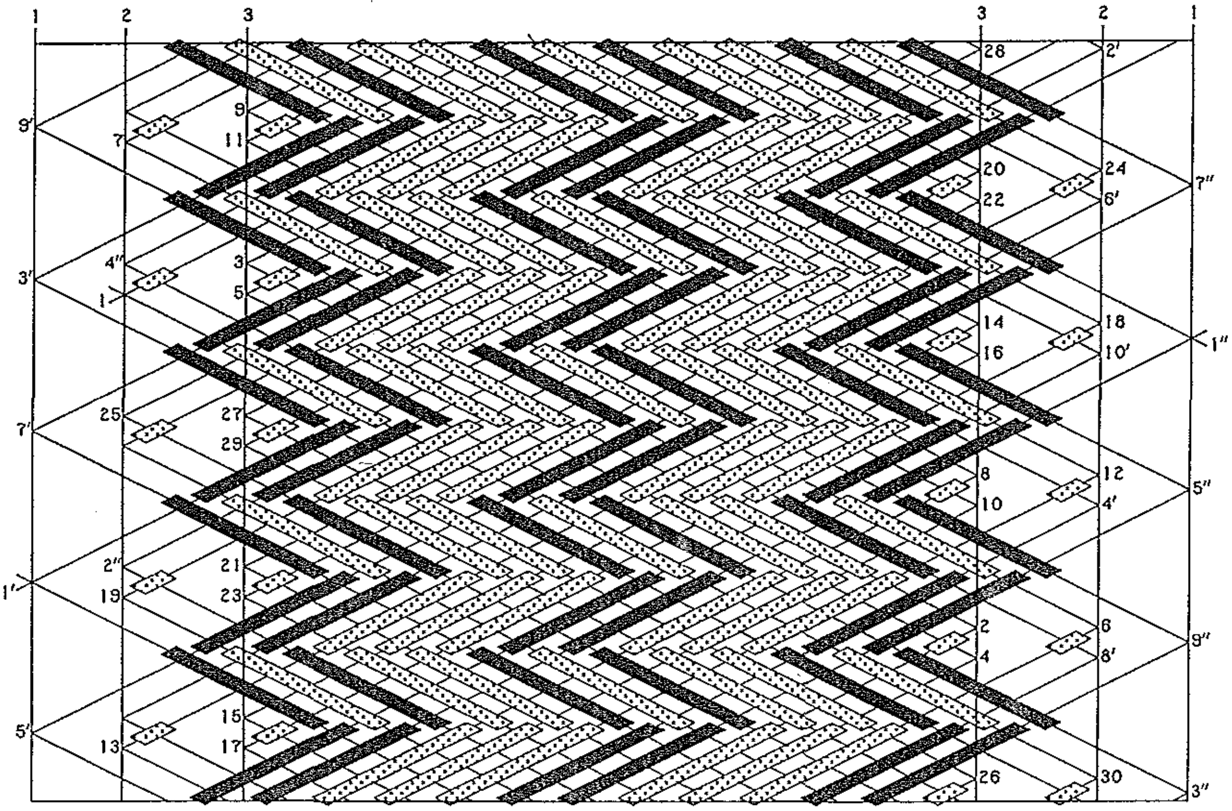
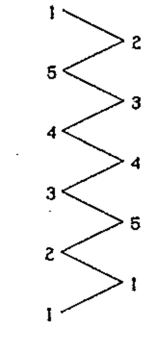


Fig. 836 — $A = 5$, $B^* = 5$, $x = 24$, $y = 6$.

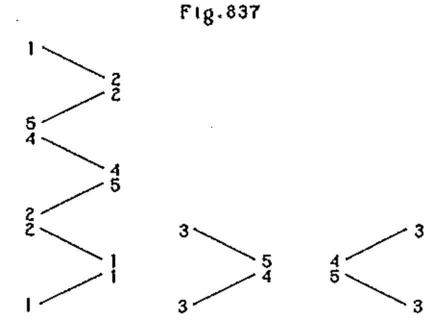
Example 4:

The Perfect Herringbone Grant Knots in Figs. 837 and 838 are all associated with the same Perfect Herringbone Pineapple Knot which has $A = 5$, $x = 10$, $y = 6$, $k = 1$, $B^* = 5$. They show a gradual increase in orientation due to colour and/or coding. The three first-return string-runs for each of the Figs. 837 and 838 associated with their associated Perfect Herringbone Pineapple Knot are shown below.



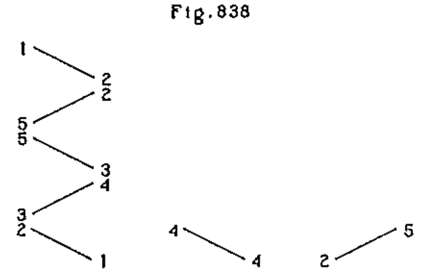
A=5, x=10, y=A+1

Fig.837



A=5, x=10, y=A+1. x_{count}=12.

Fig.838



A=5, x=10, y=A+1. x_{count}=10.

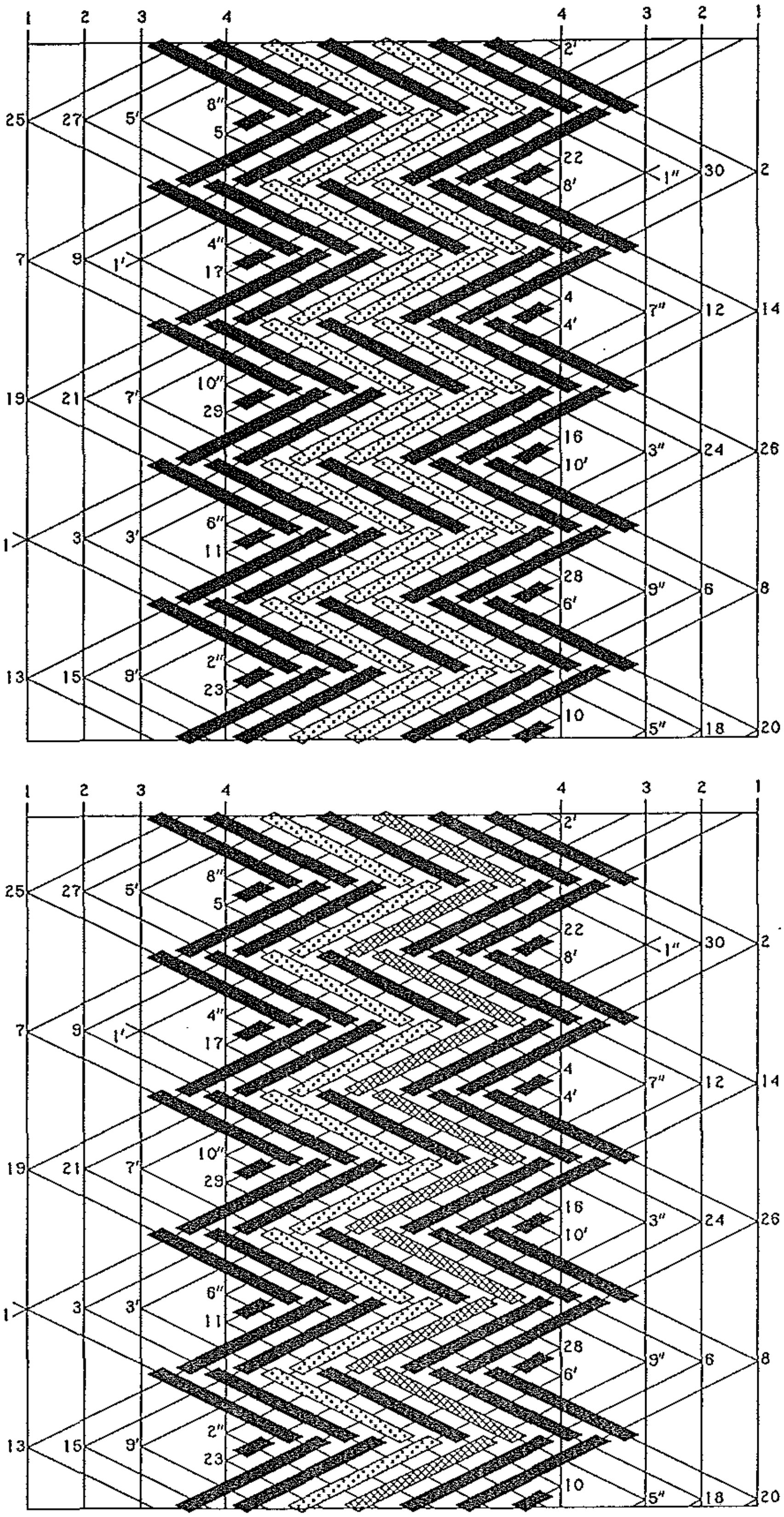


Fig. 837 — $A = 5$, $B^* = 5$, $x = 12$, $y = 6$.

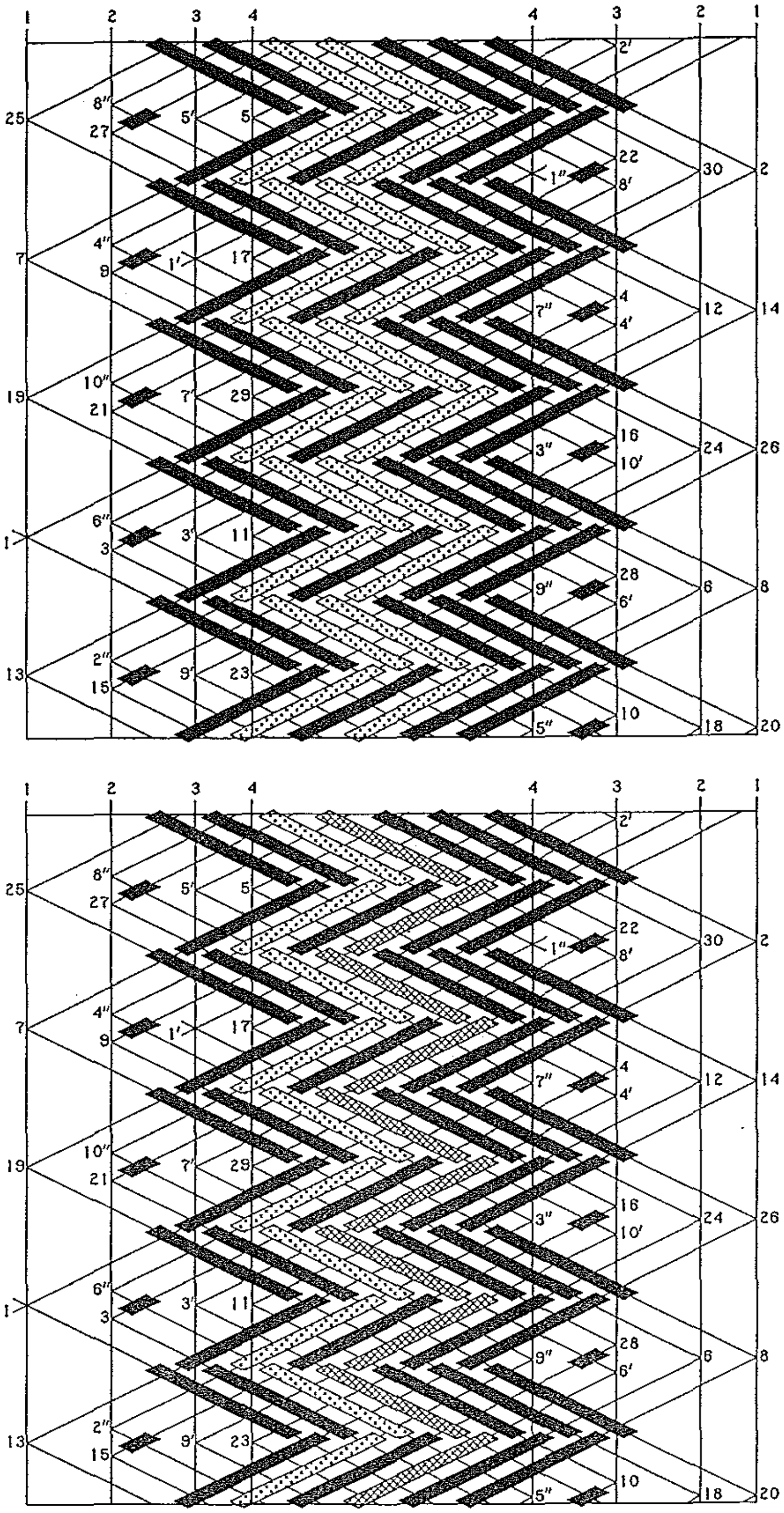


Fig. 838 — $A = 5$, $B^* = 5$, $x = 10$, $y = 6$.

THE BRAIDER'S NOTEBOOK

In *The Braider*, Issue No. 41, we discussed the Regular Cylindrical Braids with an even number of bights of which a string passes diametrically through its supporting object in order to ensure that such a Regular Cylindrical Braid could not be moved from its intended position. At the transition point of two Round Braids into one Round Braid, and especially where two Round Braids are joined, we often cover this transition point or joining point with a knot. In order for this covering knot to rest at all times very firmly against the two Round Braids, one or more strings of this covering knot pass between the two Round Braids directly above the transition point or joining point. Such a string or strings will pull the covering knot hard against the two Round Braids and ensure that the covering knot remains firmly located in that position. Generally such covering knots serve in addition as a decoration and hence often show a suitable colour-pattern. Many suitable colour-patterns can be created with two colours, hence with a minimum of two essential strings. We shall discuss the construction of such covering knots with the aid of an Example.

Fig. 839 shows the string-run of a $p/b = 18/28$ Regular Cylindrical Braid acting as such a covering knot. One string has the initial half-cycles 1 and $1'$, while the other string has the initial half-cycles $1''$ and $1'''$. Note that the half-cycles 1 and $1'$ as well as the half-cycles $1''$ and $1'''$ are $\frac{b}{2}$ bight-units apart. Also note that the half-cycles 1 and $1''$ as well as the half-cycles $1'$ and $1'''$, when produced to the left bight-boundary, intersect on this bight-boundary.

The last half-cycle associated with the initial half-cycle 1 is half-cycle $(\frac{b}{2}+1)$, and simlarly the last half-cycle associated with the initial half-cycle $1'$ is half-cycle $(\frac{b}{2}+1)'$, the last half-cycle associated with the initial half-cycle $1''$ is half-cycle $(\frac{b}{2}+1)''$, the last half-cycle associated with the initial half-cycle $1'''$ is half-cycle $(\frac{b}{2}+1)'''$.

Let's braid the string-run half-cycles $1-2-3-\cdots-13-14-15$ and $1'-2'-2'-\cdots-13'-14'-15'$ by parallel braiding, and do the same with the string-run half-cycles $1''-2''-2''-\cdots-13''-14''-15''$ and $1'''-2'''-2'''-\cdots-13'''-14'''-15'''$. The algorithm diagram associated with the string-run of each of the two $p'/b' = 9/14$ interwoven Regular Knot components[†] is shown at upper-right below the string-run diagram. Since the maximum i-value is $\frac{(b'+1)-3}{2} = \frac{(14+1)-3}{2} = 6$, we can disregard $i > 6$. Hence the upper two rows and the lower two rows of i-values can be replaced by a single row of i-values as shown in the next two string-run algorithm diagrams, the first of which (option 1) is associated with first parallel braiding the string-run half-cycles $1-2-3-\cdots-13-14-15$ and $1'-2'-2'-\cdots-13'-14'-15'$, and the last of which (option 2) is associated with first parallel braiding the string-run half-cycles $1''-2''-2''-\cdots-13''-14''-15''$ and $1'''-2'''-2'''-\cdots-13'''-14'''-15'''$. In case of option 1, the first two half-cycles to be laid down (1 and $1'$ from upper-left to lower-right), or in case of option 2, the first two half-cycles to be laid down ($1''$ and $1'''$ from lower-left to upper-right), are **free runs**. In case of option 1, the last two half-cycles to be laid down ($(b'+1) = 15$ and $(b'+1)' = 15'$ from upper-left to lower-right), or in case of option 2, the last two half-cycles to be laid down ($(b'+1)'' = 15''$ and $(b'+1)''' = 15'''$ from lower-left to upper-right), have **unders to the right** of the X—X line. For the even-numbered half-cycles h_e and $h_e{}'$ from upper-right to lower-left, the intersection associated with $i = \frac{h_e-2}{2} = \frac{h_e{}'-2}{2}$ is an intersection with half-cycle 1 or $1'$ and when **left** of the X—X line is an **over**. For the even-numbered half-cycles $h_e{}''$ and $h_e{}'''$ from lower-right to upper-left, the intersection associated with $i = \frac{h_e{}''-2}{2} = \frac{h_e{}'''-2}{2}$ is an intersection with half-cycle $1''$ or $1'''$ and when **left** of the X—X line is an **over**.

[†] Refer to *The Braider*, Issue No. 41, pp. 973-974.

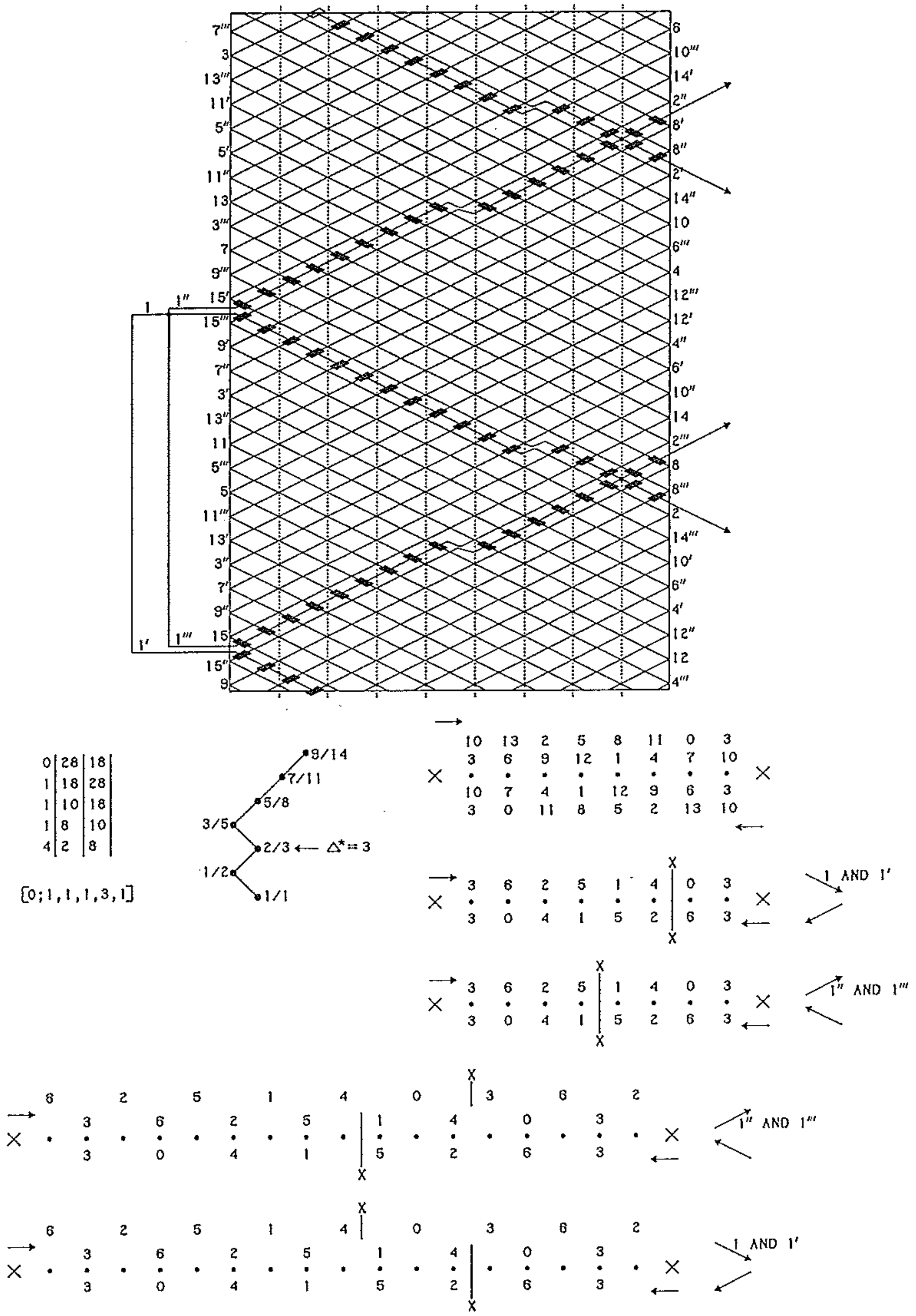


Fig. 839 — A string-run example with its general algorithm diagrams.

In case of option 1, after braiding the component with the initial half-cycles 1 and $1'$ from upper-left to lower-right, we braid the component with the initial half-cycles $1''$ and $1'''$ from lower-left to upper-right. The general algorithm diagram associated with this is the second from the bottom. For the half-cycles $3'' \leq h_o'' \leq (b'-1)'' = 13''$ and $3''' \leq h_o''' \leq (b'-1)''' = 13'''$ from lower-left to upper-right, the intersection set associated with the i-value $i = \frac{h_o''-3}{2} = \frac{h_o'''-3}{2}$ is an intersection set with half-cycles 1 and $(b'+1)' = 15'$ or $1'$ and $(b'+1) = 15$; when **left** of the upper X line it is an *over*$-\star$ intersection set, and when **right** of the upper X line it is a $\star -$ *over* intersection set. The associated sequence of i-values is the upper sequence in the general algorithm diagram. This sequence starts with the i-value for the half-cycles $(b'+1)'' = 15''$ and $(b'+1)''' = 15'''$ and of course follows the sequential order of the i-values for the odd-numbered half-cycles h_o'' and h_o'''.

For the initial half-cycles $1''$ and $1'''$ from lower-left to upper-right, and the final half-cycles $(b'+1)''$ and $(b'+1)'''$ from lower-left to upper-right, there are four string-run configurations to consider (see the left four diagrams in Fig. 840)

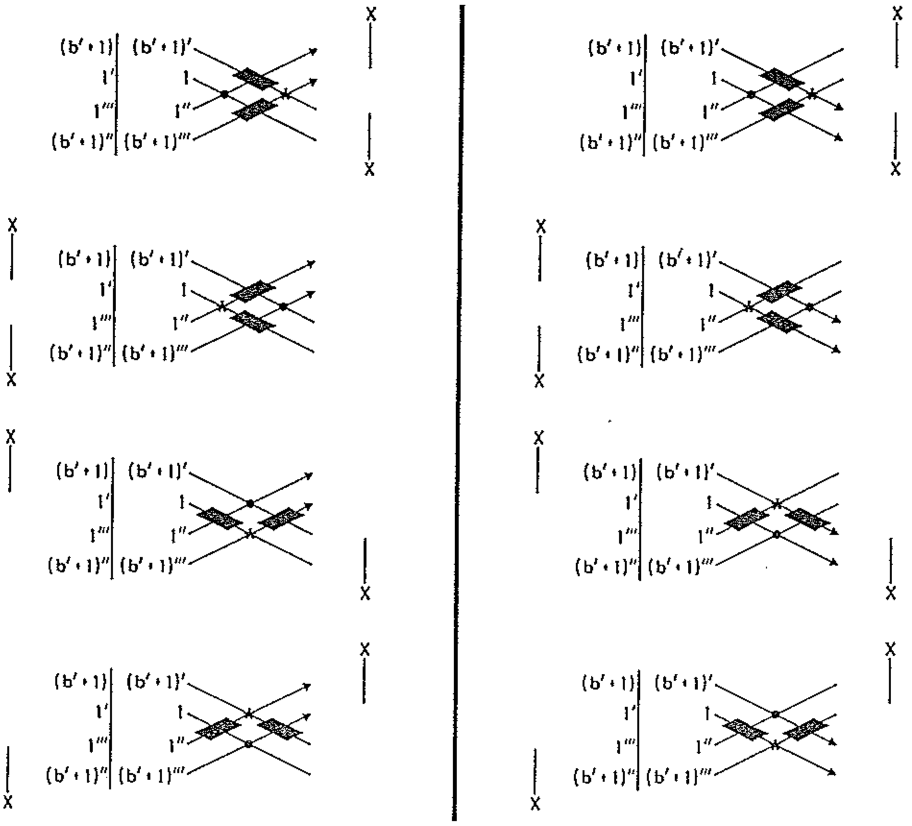


Fig. 840 — The four string-run configurations of the initial and final half-cycles for options 1 and 2.

In these configurations the coding of the intersection with the ● can be freely chosen, and the coding of the intersection with the star is its particular coding in the coding-pattern of the braid. For the initial half-cycles $1''$ and $1'''$ they form, in association with the i-value $\frac{(b'+1)-3}{2}$ in the uppermost row of i-values, the intersection set ● $-$ *under* or $\star -$ *over* or *under* $-$ ● or *over* $- \star$, depending on upper and lower X line positions. For the final half-cycles $(b'+1)''$ and $(b'+1)'''$ they form, in association with the i-value $\frac{(b'+1)-3}{2}$ in the uppermost row of i-values, the intersection set *over* $- \star$ or *under* $-$ ●

or $\star -$ *over* or $\bullet -$ *under*, depending on upper and lower X line positions. Note that adjacent to the left bight-boundary we have the uppermost arrangement in Fig. 840 without the intersection with the $\bullet$, and that adjacent to the right bight-boundary we may have the second arrangement from the top in Fig. 840 without the intersection with the $\bullet$. Furthermore, for the initial half-cycles $1''$ and $1'''$ from lower-left to upper-right the coding of the remaining intersections below the i-values $i < \frac{(b'+1)-3}{2}$ in the uppermost row left of the lower X line are **unders**, while the coding of the remaining intersections right of the lower X line correspond with the coding associated with the i-values in the uppermost row. For the final half-cycles $(b'+1)''$ and $(b'+1)'''$ from lower-left to upper-right the coding of the remaining intersections below the i-values $i < \frac{(b'+1)-3}{2}$ in the uppermost row right of the lower X line are **unders**, while the coding of the remaining intersections left of the lower X line correspond with the coding associated with the i-values in the uppermost row.

For the even-numbered half-cycles h_e'' and h_e''' from lower-right to upper-left, the intersection associated with $i = \frac{h_e''-2}{2} = \frac{h_e'''-2}{2}$ is an intersection with half-cycle $1''$ or $1'''$ and when **left** of the lower X line is an **over**.

Thus in our Example (Fig. 839), half-cycles $1''$ and $1'''$ from lower-left to upper-right have each **unders** for uppermost $i < 6$ left of lower X line, u for uppermost $i = 6$ adjacent left bight-boundary, and $\star - o$ for uppermost $i = 6$ right of both X lines. Half-cycles $(b'+1)'' = 15''$ and $(b'+1)''' = 15'''$ have each **unders** for uppermost $i < 6$ right of lower X line, $o - \star$ for uppermost $i = 6$ left of both X lines, and $u - \bullet$ for uppermost $i = 6$ right of both X lines. For the even-numbered half-cycles h_e'' and h_e''' from lower-right to upper-left, the intersection associated with $i = \frac{h_e''-2}{2} = \frac{h_e'''-2}{2}$ is an intersection with half-cycle $1''$ or $1'''$ and when **left** of the lower X line is an **over**.

In case of option 2, after braiding the component with the initial half-cycles $1''$ and $1'''$ from lower-left to upper-right, we braid the component with the initial half-cycles 1 and $1'$ from upper-left to lower-right. The general algorithm diagram associated with this is the one at the bottom of Fig. 839. For the half-cycles $3 \leq h_o \leq (b'-1) = 13$ and $3' \leq h_o' \leq (b'-1)' = 13'$ from upper-left to lower-right, the intersection set associated with the i-value $i = \frac{h_o-3}{2} = \frac{h_o'-3}{2}$ is an intersection set with half-cycles $1''$ and $(b'+1)''' = 15'''$ or $1'''$ and $(b'+1)'' = 15''$; when **left** of the upper X line it is an *over*$-\star$ intersection set, and when **right** of the upper X line it is a $\star -$ *over* intersection set. The associated sequence of i-values is the upper sequence in the general algorithm diagram. This sequence starts with the i-value for the half-cycles $(b'+1) = 15$ and $(b'+1)' = 15'$ and of course follows the sequential order of the i-values for the odd-numbered half-cycles h_o and h_o'. For the initial half-cycles 1 and $1'$ from upper-left to lower-right, and the final half-cycles $(b'+1)$ and $(b'+1)'$ from upper-left to lower-right, there are four string-run configurations to consider (see the right four diagrams in Fig. 840) In these configurations the coding of the intersection with the $\bullet$ can be freely chosen, and the coding of the intersection with the star is its particular coding in the coding-pattern of the braid. For the initial half-cycles 1 and $1'$ they form, in association with the i-value $\frac{(b'+1)-3}{2}$ in the uppermost row of i-values, the intersection set $\bullet -$ *under* or $\star -$ *over* or *under* $- \bullet$ or *over* $- \star$, depending on upper and lower X line positions. For the final half-cycles $(b'+1)$ and $(b'+1)'$ they form, in association with the i-value $\frac{(b'+1)-3}{2}$ in the uppermost row of i-values, the intersection set *over* $- \star$ or *under* $- \bullet$ or $\star -$ *over* or $\bullet -$ *under*, depending on upper and lower X line positions. Note that adjacent to the left bight-boundary we have the uppermost arrangement in Fig. 840

without the intersection with the •, and that adjacent to the right bight-boundary we may have the second arrangement from the top in Fig. 840 without the intersection with the •. Furthermore, for the initial half-cycles 1 and 1′ from upper-left to lower-right the coding of the remaining intersections below the i-values $i < \frac{(b'+1)-3}{2}$ in the uppermost row left of the lower X line are **unders**, while the coding of the remaining intersections right of the lower X line correspond with the coding associated with the i-values in the uppermost row. For the final half-cycles $(b'+1)$ and $(b'+1)'$ from upper-left to lower-right the coding of the remaining intersections below the i-values $i < \frac{(b'+1)-3}{2}$ in the uppermost row right of the lower X line are **unders**, while the coding of the remaining intersections left of the lower X line correspond with the coding associated with the i-values in the uppermost row.

For the even-numbered half-cycles h_e and $h_e{}'$ from upper-right to lower-left, the intersection associated with $i = \frac{h_e-2}{2} = \frac{h_e{}'-2}{2}$ is an intersection with half-cycle 1 or 1′ and when **left** of the lower X line is an **over**.

Thus in our Example (Fig. 839), half-cycles 1 and 1′ have each **unders** for uppermost $i < 6$ left of lower X line, u for uppermost $i = 6$ adjacent left bight-boundary, and $\star - o$ for uppermost $i = 6$ right of both X lines. Half-cycles $(b'+1) = 15$ and $(b'+1)' = 15'$ have each **unders** for uppermost $i < 6$ right of lower X line, $o - \star$ for uppermost $i = 6$ left of both X lines, and $u - \bullet$ for uppermost $i = 6$ right of both X lines. For the even-numbered half-cycles h_e and $h_e{}'$ the intersection associated with $i = \frac{h_e-2}{2} = \frac{h_e{}'-2}{2}$ is an intersection with half-cycle 1 or 1′ and when **left** of the lower X line is an **over**.

A coding we could place on the string-run in Fig. 839 is a two-pass Herringbone coding as shown in Fig. 841. The associated algorithm diagrams are shown in Fig. 842.

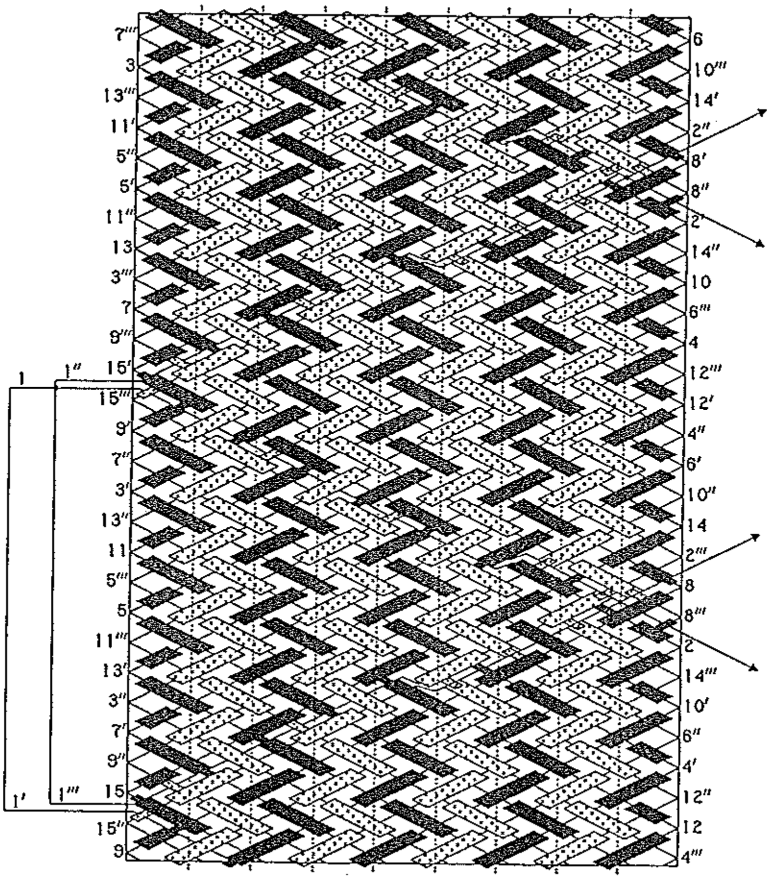


Fig. 841 — A two-pass Herringbone coding on the string-run in Fig. 839.

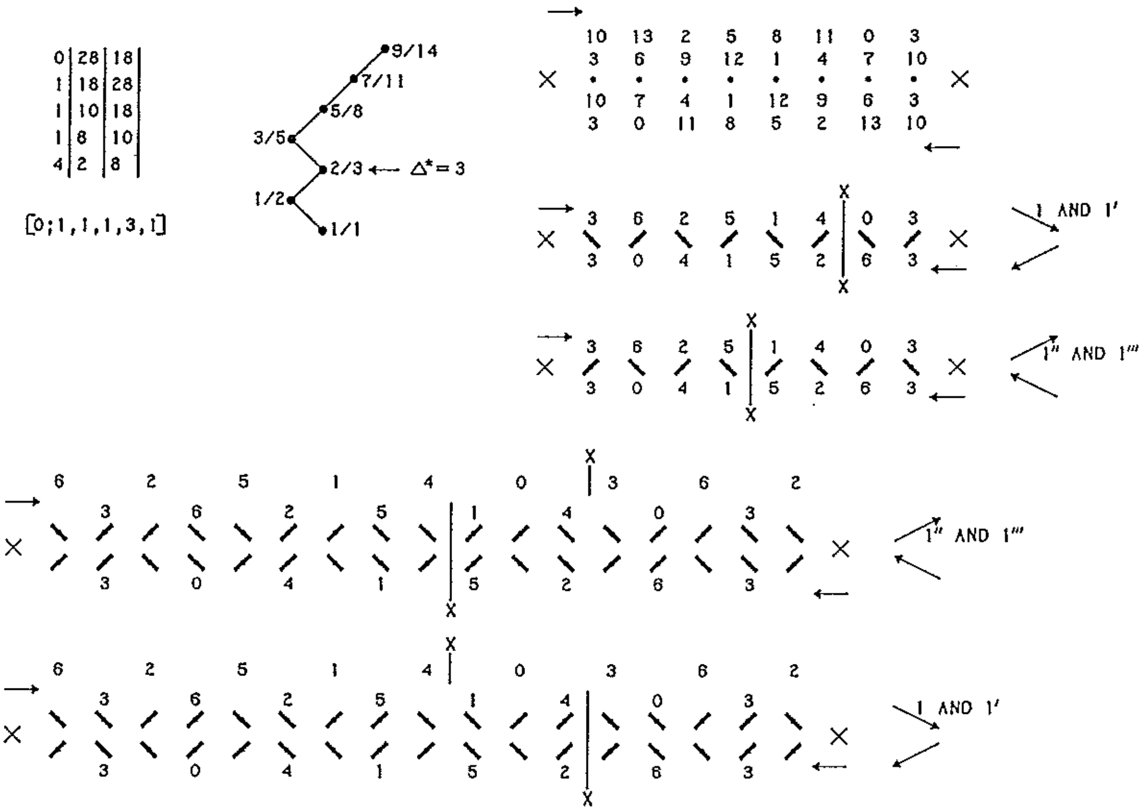


Fig. 842 — The algorithm diagrams associated with Fig. 841.

Option 1 gives for the first component with the initial half-cycles 1 and $1'$ from upper-left to lower-right the following half-cycle braiding algorithms:

half-cycles:

$1 \,\&\, 1'$: : $L \longrightarrow R$: Free run.
$2 \,\&\, 2'$: $i = 0$; o for $i = 0$ left of X–X: $L \longleftarrow R$: o.
$3 \,\&\, 3'$: $i = 0$; : $L \longrightarrow R$: o.
$4 \,\&\, 4'$: $i \leq 1$; o for $i = 1$ left of X–X: $L \longleftarrow R$: $2o$.
$5 \,\&\, 5'$: $i \leq 1$; : $L \longrightarrow R$: $2o$.
$6 \,\&\, 6'$: $i \leq 2$; o for $i = 2$ left of X–X: $L \longleftarrow R$: $3o$.
$7 \,\&\, 7'$: $i \leq 2$; : $L \longrightarrow R$: $3o$.
$8 \,\&\, 8'$: $i \leq 3$; o for $i = 3$ left of X–X: $L \longleftarrow R$: $5o$.
$9 \,\&\, 9'$: $i \leq 3$; : $L \longrightarrow R$: $4o - u$.
$10 \,\&\, 10'$: $i \leq 4$; o for $i = 4$ left of X–X: $L \longleftarrow R$: $5o - u$.
$11 \,\&\, 11'$: $i \leq 4$; : $L \longrightarrow R$: $3o - u - o - u$.
$12 \,\&\, 12'$: $i \leq 5$; o for $i = 5$ left of X–X: $L \longleftarrow R$: $4o - u - o - u$.
$13 \,\&\, 13'$: $i \leq 5$; : $L \longrightarrow R$: $2o - u - o - u - o - u$.
$14 \,\&\, 14'$: $i \leq 6$; o for $i = 6$ left of X–X: $L \longleftarrow R$: $o - u - o - u - o - u - o - u$.
$15 \,\&\, 15'$: $i \leq 6$; unders right of X–X: $L \longrightarrow R$: $o - u - o - u - o - u - 2u$.

Option 1 gives for the second component with the initial half-cycles $1''$ and $1'''$ from lower-left to upper-right the following half-cycle braiding algorithms:

half-cycles:

$1'' \,\&\, 1'''$: u for uppermost $i < 6$ left of lower X line and
u for uppermost $i = 6$ adjacent left bight-boundary and
$\star - o = 2o$ for uppermost $i = 6$ right of both X lines:
$L \longrightarrow R$: $5u - o - u - 2o - u$.

$2''$ & $2'''$: $i = 0$; o for $i = 0$ left of lower X line:
$L \longleftarrow R\colon u - o - u - o - u - o - u - 2o - u\,.$
$3''$ & $3'''$: $i = 0$; $o - \star = 2o$ for uppermost $i = 0$ left of upper X line:
$L \longrightarrow R\colon u - o - u - o - u - 2o - u - 2o - u\,.$
$4''$ & $4'''$: $i \leq 1$; o for $i = 1$ left of lower X line:
$L \longleftarrow R\colon u - o - u - o - u - 2o - u - 2o - u\,.$
$5''$ & $5'''$: $i \leq 1$; $o - \star = 2o$ for uppermost $i = 1$ left of upper X line:
$L \longrightarrow R\colon u - o - u - 2o - u - 2o - u - 2o - u\,.$
$6''$ & $6'''$: $i \leq 2$; o for $i = 2$ left of lower X line:
$L \longleftarrow R\colon u - o - u - 2o - u - 2o - u - 2o - u\,.$
$7''$ & $7'''$: $i \leq 2$; $o - \star = 2o$ for uppermost $i = 2$ left of upper X line and
$\star - o = u - o$ for uppermost $i = 2$ right of upper X line:
$L \longrightarrow R\colon u - 2o - u - 2o - u - 2o - u - 2o - u - o\,.$
$8''$ & $8'''$: $i \leq 3$; o for $i = 3$ left of lower X line:
$L \longleftarrow R\colon u - 2o - u - 2o - u - 2o - u - 3o - u\,.$
$9''$ & $9'''$: $i \leq 3$; $\star - o = u - o$ for uppermost $i = 3$ right of upper X line:
$L \longrightarrow R\colon u - 2o - u - 2o - u - 2o - u - 3o - 2u\,.$
$10''$ & $10'''$: $i \leq 4$; o for $i = 4$ left of lower X line:
$L \longleftarrow R\colon u - 2o - u - 2o - u - 3o - u - 2o - 2u\,.$
$11''$ & $11'''$: $i \leq 4$; $o - \star = o - u$ for uppermost $i = 4$ left of upper X line:
$L \longrightarrow R\colon u - 2o - u - 3o - u - 2o - 2u - 2o - 2u\,.$
$12''$ & $12'''$: $i \leq 5$; o for $i = 5$ left of lower X line:
$L \longleftarrow R\colon u - 2o - u - 2o - 2u - 2o - 2u - 2o - 2u\,.$
$13''$ & $13'''$: $i \leq 5$; $o - \star = o - u$ for uppermost $i = 5$ left of upper X line:
$L \longrightarrow R\colon u - 3o - u - 2o - 2u - 2o - 2u - 2o - 2u\,.$
$14''$ & $14'''$: $i \leq 6$; o for $i = 6$ left of lower X line:
$L \longleftarrow R\colon u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - 2u\,.$
$15''$ & $15'''$: $i \leq 6$; u for uppermost $i < 6$ right of lower X line and
$o - \star = o - u$ for uppermost $i = 6$ left of both X lines and
$u - \bullet$ for uppermost $i = 6$ right of both X lines:
$L \longrightarrow R\colon o - u - 2o - 2u - 2o - 2u - 6u - \bullet - 2u\,.$

Option 2 gives for the first component with the initial half-cycles $1''$ and $1'''$ from lower-left to upper-right the following half-cycle braiding algorithms:

half-cycles:
$1''$ & $1'''$: : $L \longrightarrow R$: Free run.
$2''$ & $2'''$: $i = 0$; o for $i = 0$ left of X–X: $L \longleftarrow R\colon o\,.$
$3''$ & $3'''$: $i = 0$; : $L \longrightarrow R\colon o\,.$
$4''$ & $4'''$: $i \leq 1$; o for $i = 1$ left of X–X: $L \longleftarrow R\colon 2o\,.$
$5''$ & $5'''$: $i \leq 1$; : $L \longrightarrow R\colon 2o\,.$
$6''$ & $6'''$: $i \leq 2$; o for $i = 2$ left of X–X: $L \longleftarrow R\colon 3o\,.$
$7''$ & $7'''$: $i \leq 2$; : $L \longrightarrow R\colon 3o\,.$
$8''$ & $8'''$: $i \leq 3$; o for $i = 3$ left of X–X: $L \longleftarrow R\colon 5o\,.$
$9''$ & $9'''$: $i \leq 3$; : $L \longrightarrow R\colon 4o - u\,.$
$10''$ & $10'''$: $i \leq 4$; o for $i = 4$ left of X–X: $L \longleftarrow R\colon 5o - u\,.$
$11''$ & $11'''$: $i \leq 4$; : $L \longrightarrow R\colon 3o - u - o - u\,.$
$12''$ & $12'''$: $i \leq 5$; o for $i = 5$ left of X–X: $L \longleftarrow R\colon 2o - u - o - u - o - u\,.$
$13''$ & $13'''$: $i \leq 5$; : $L \longrightarrow R\colon 2o - u - o - u - o - u\,.$

$14'' \& 14'''$: $i \leq 6$; o for $i = 6$ left of X–X: $L \longleftarrow R: o - u - o - u - o - u - o - u$.
$15'' \& 15'''$: $i \leq 6$; unders right of X–X: $L \longrightarrow R: o - u - o - 5u$.

Option 2 gives for the second component with the initial half-cycles 1 and $1'$ from upper-left to lower-right the following half-cycle braiding algorithms:

half-cycles:
$1 \& 1'$: u for uppermost $i < 6$ left of lower X line and
u for uppermost $i = 6$ adjacent left bight-boundary and
$\star - o = u - o$ for uppermost $i = 6$ right of both X lines:
$L \longrightarrow R: 6u - o - u - 2o$.
$2 \& 2'$: $i = 0$; o for $i = 0$ left of lower X line:
$L \longleftarrow R: o - u - o - u - o - u - 2o - u - o$.
$3 \& 3'$: $i = 0$; $\star - o = u - o$ for uppermost $i = 0$ right of upper X line:
$L \longrightarrow R: o - u - o - u - o - u - 2o - u - o$.
$4 \& 4'$: $i \leq 1$; o for $i = 1$ left of lower X line:
$L \longleftarrow R: o - u - o - u - 2o - u - 2o - u - o$.
$5 \& 5'$: $i \leq 1$; $o - \star = o - u$ for uppermost $i = 1$ left of upper X line:
$L \longrightarrow R: o - u - 2o - u - 2o - u - 2o - u - o$.
$6 \& 6'$: $i \leq 2$; o for $i = 2$ left of lower X line:
$L \longleftarrow R: o - u - 2o - u - 2o - u - 2o - u - o$.
$7 \& 7'$: $i \leq 2$; $o - \star = o - u$ for uppermost $i = 2$ left of upper X line and
$\star - o = 2o$ for uppermost $i = 2$ right of upper X line:
$L \longrightarrow R: 2o - u - 2o - u - 2o - u - 2o - u - 2o$.
$8 \& 8'$: $i \leq 3$; o for $i = 3$ left of lower X line:
$L \longleftarrow R: 2o - u - 2o - u - 2o - u - 2o - u - 2o$.
$9 \& 9'$: $i \leq 3$; $\star - o = 2o$ for uppermost $i = 3$ right of upper X line:
$L \longrightarrow R: 2o - u - 2o - u - 2o - u - 3o - 2u - o$.
$10 \& 10'$: $i \leq 4$; o for $i = 4$ left of lower X line:
$L \longleftarrow R: 2o - u - 2o - u - 2o - u - 3o - 2u - o$.
$11 \& 11'$: $i \leq 4$; $o - \star = 2o$ for uppermost $i = 4$ left of upper X line:
$L \longrightarrow R: 2o - u - 2o - u - 3o - 2u - 2o - 2u - o$.
$12 \& 12'$: $i \leq 5$; o for $i = 5$ left of lower X line:
$L \longleftarrow R: 2o - u - 2o - u - 3o - 2u - 2o - 2u - o$.
$13 \& 13'$: $i \leq 5$; $o - \star = 2o$ for uppermost $i = 5$ left of upper X line:
$L \longrightarrow R: 2o - u - 3o - 2u - 2o - 2u - 2o - 2u - o$.
$14 \& 14'$: $i \leq 6$; o for $i = 6$ left of lower X line:
$L \longleftarrow R: 2o - 2u - 2o - 2u - 2o - 2u - 2o - 2u - o$.
$15 \& 15'$: $i \leq 6$; u for uppermost $i < 6$ right of lower X line and
$o - \star = 2o$ for uppermost $i = 6$ left of both X lines and
$u - \bullet$ for uppermost $i = 6$ right of both X lines:
$L \longrightarrow R: 3o - 2u - 2o - 2u - 2o - 5u - \bullet - 2u$.

As mentioned earlier, the coding which is associated with the $\bullet$ crossing can be freely chosen, however, it is in most cases convenient to take for this coding the one which simplifies braiding. For example, in option 1 we would braid the half-cycles $15'' \& 15'''$ as $o - u - 2o - 2u - 2o - 2u - 9u$, and in option 2 we would braid the half-cycles $15 \& 15'$ as $3o - 2u - 2o - 2u - 2o - 8u$.

THE BRAIDER

No.47 **AUGUST 2006.**

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A quarterly publication
for
the braiding artisan

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A Braiding Project — Key-hanger No. 1

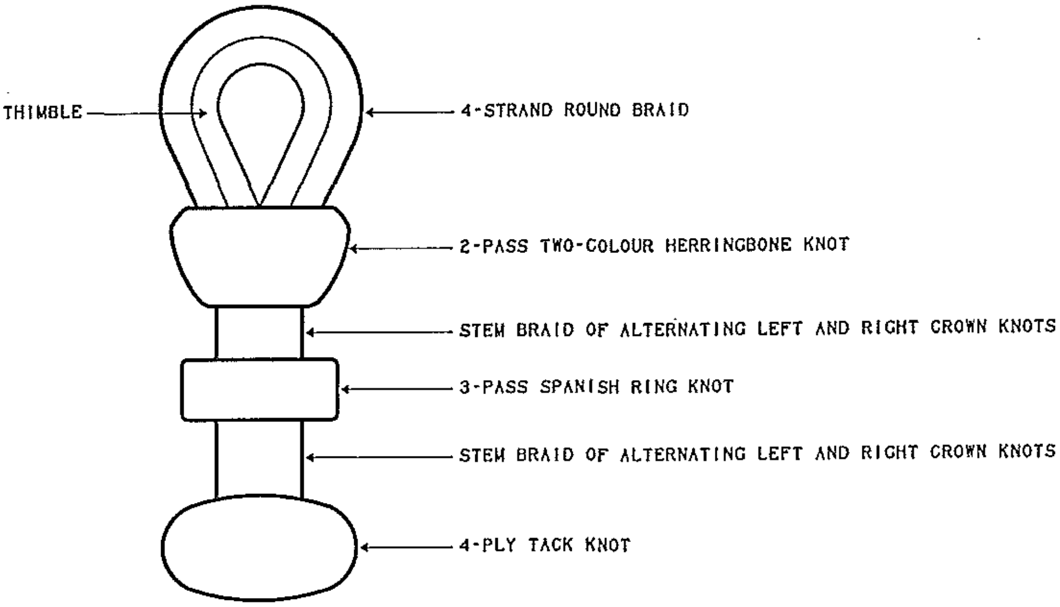
THIMBLE
4-STRAND ROUND BRAID
2-PASS TWO-COLOUR HERRINGBONE KNOT
STEM BRAID OF ALTERNATING LEFT AND RIGHT CROWN KNOTS
3-PASS SPANISH RING KNOT
STEM BRAID OF ALTERNATING LEFT AND RIGHT CROWN KNOTS
4-PLY TACK KNOT

Fig. 843 — Key-hanger No. 1. Cord diameter 2 mm.

The braid, forming the eye around a thimble of 25 mm, is a 4-cord under-over Round Braid (see Fig. 844) made at the centre of the cord lengths.

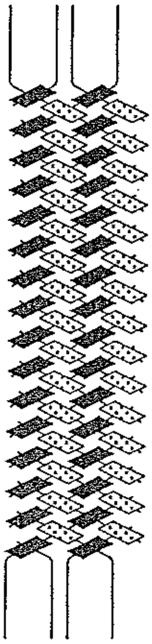

Fig. 844 — The 4-cord under-over Round Braid.

Put this braid tightly around the thimble and with a Double Constrictor Knot (see Fig. 845) secure both 'ends' immediately below the thimble.

Immediately below this constrictor knot start braiding the stem. The braid of the stem consists of a sequence of Crown Knots, one on top the other as shown in Figs. 846 and 847. The four cords of a Crown Knot have all the same colour while the colour of the four cords of the odd numbered Crown Knots differs from the colour of the four cords of the even numbered Crown Knots.

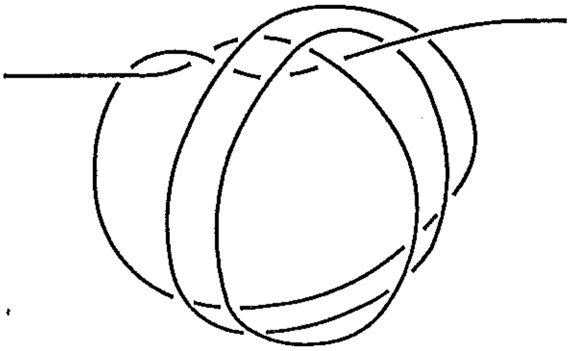

Fig. 845 — The Double Constrictor Knot.

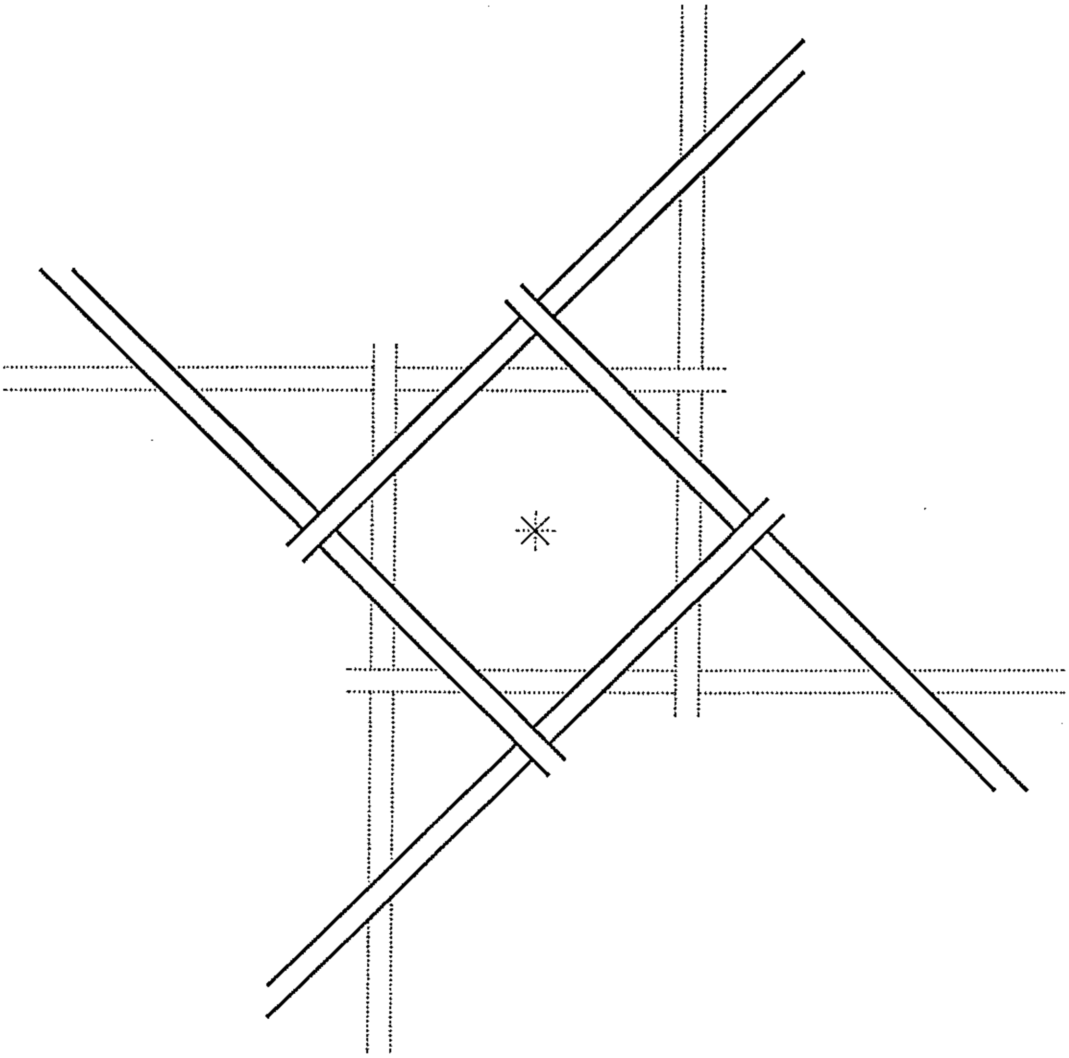

Fig. 846 — The position of two successive Crown Knots.

Fig. 847 shows the successive braiding of the odd and even numbered Crown Knots. At between 1/3 and 1/2 of the final length of the stem (final stem-length approximately 45 mm) place a cord diametrically across the stem; this cord will later be used for braiding the Spanish Ring Knot. When the final stem-length has been reached and the braid is nice and tight, tie off with a Double Constrictor Knot.

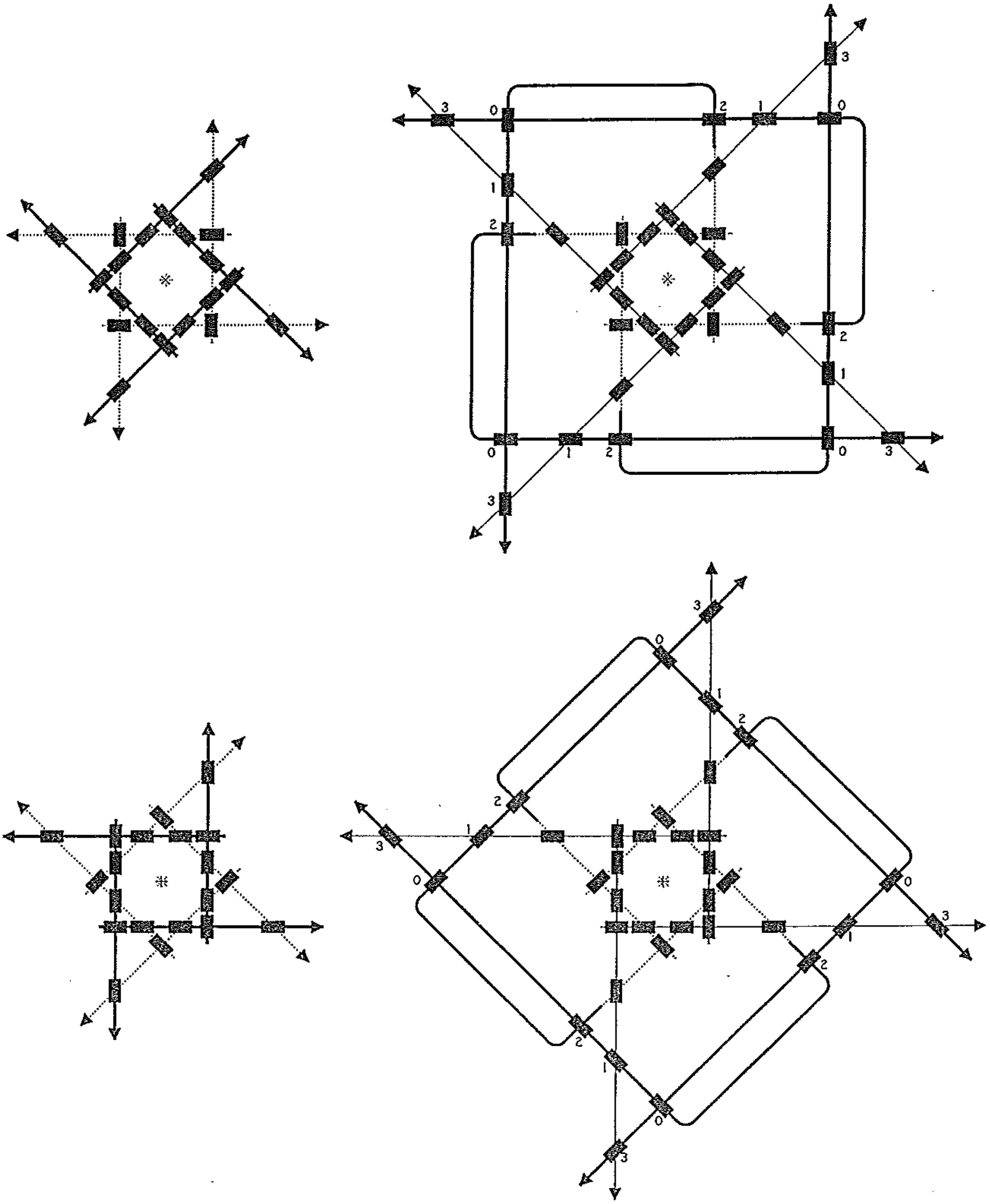

Fig. 847 — Successive braiding stages of the odd and even numbered Crown Knots.

The end-knot is a four-ply Tack Knot[†] made with the cords of the stem-braid. The upper grid-diagrams in Figs. 848 to 850 show one way of braiding this knot while the lower grid-diagrams in Figs. 848 to 850 show an alternative way.

[†] A Tack Knot is a Manrope Knot (first Wall, then Crown) with the string ends tucked under the Wall Knot along the stem of the rope.

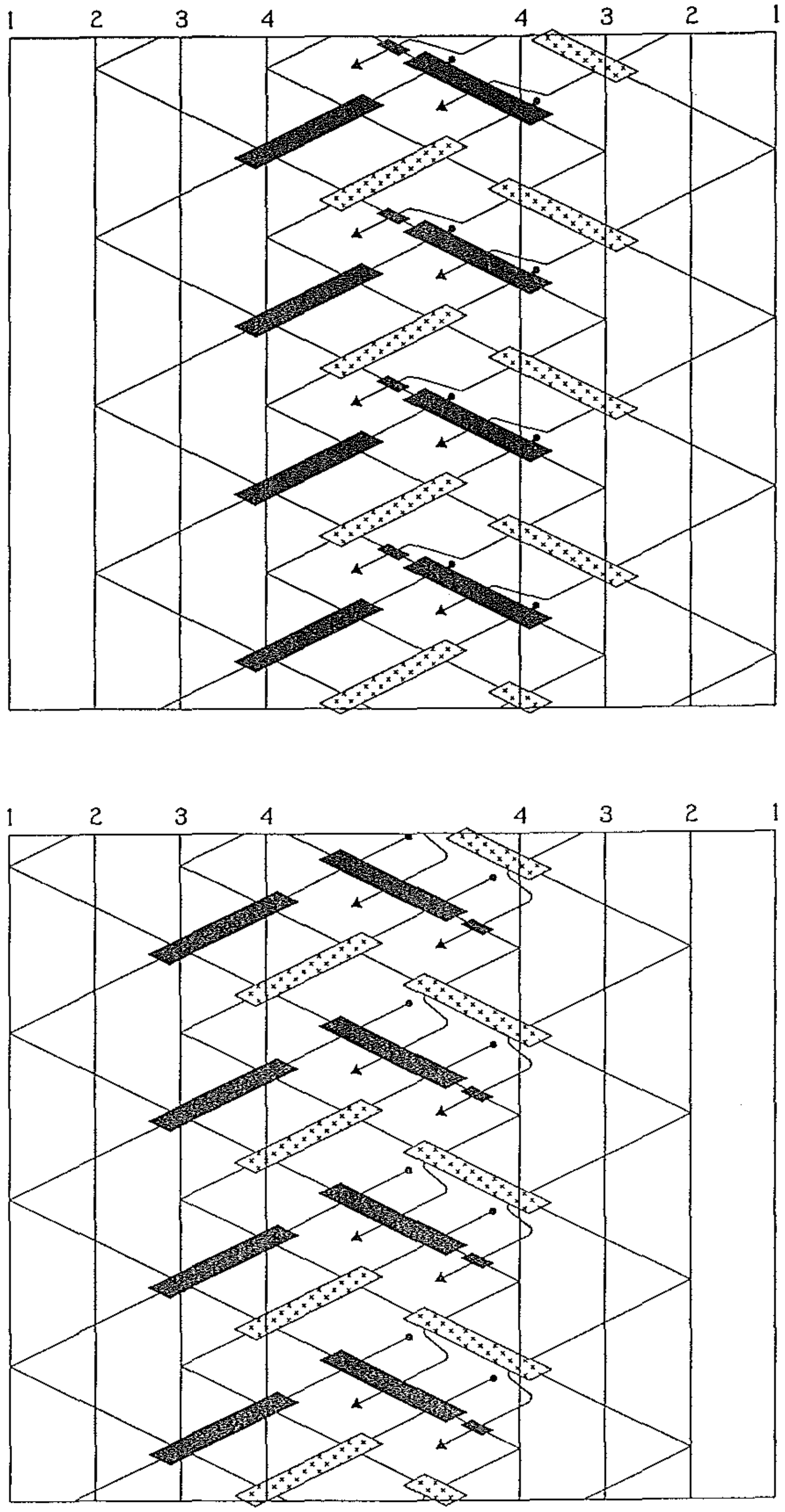

Fig. 848 — The first stage in the construction of the 4-ply Tack Knot.

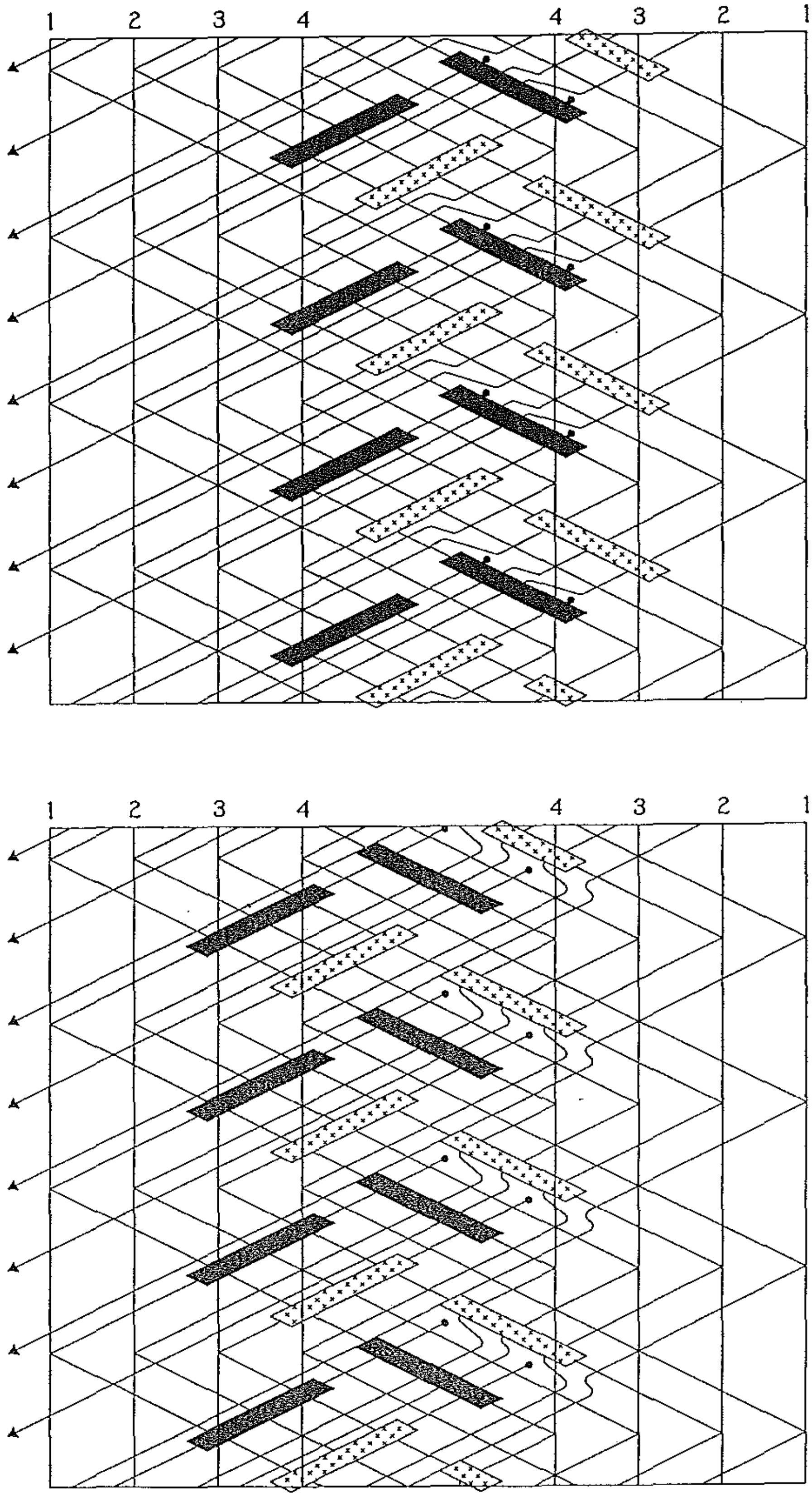

Fig. 849 — Fig. 848 with the continuation of the string-run of the 4-ply Tack Knot.

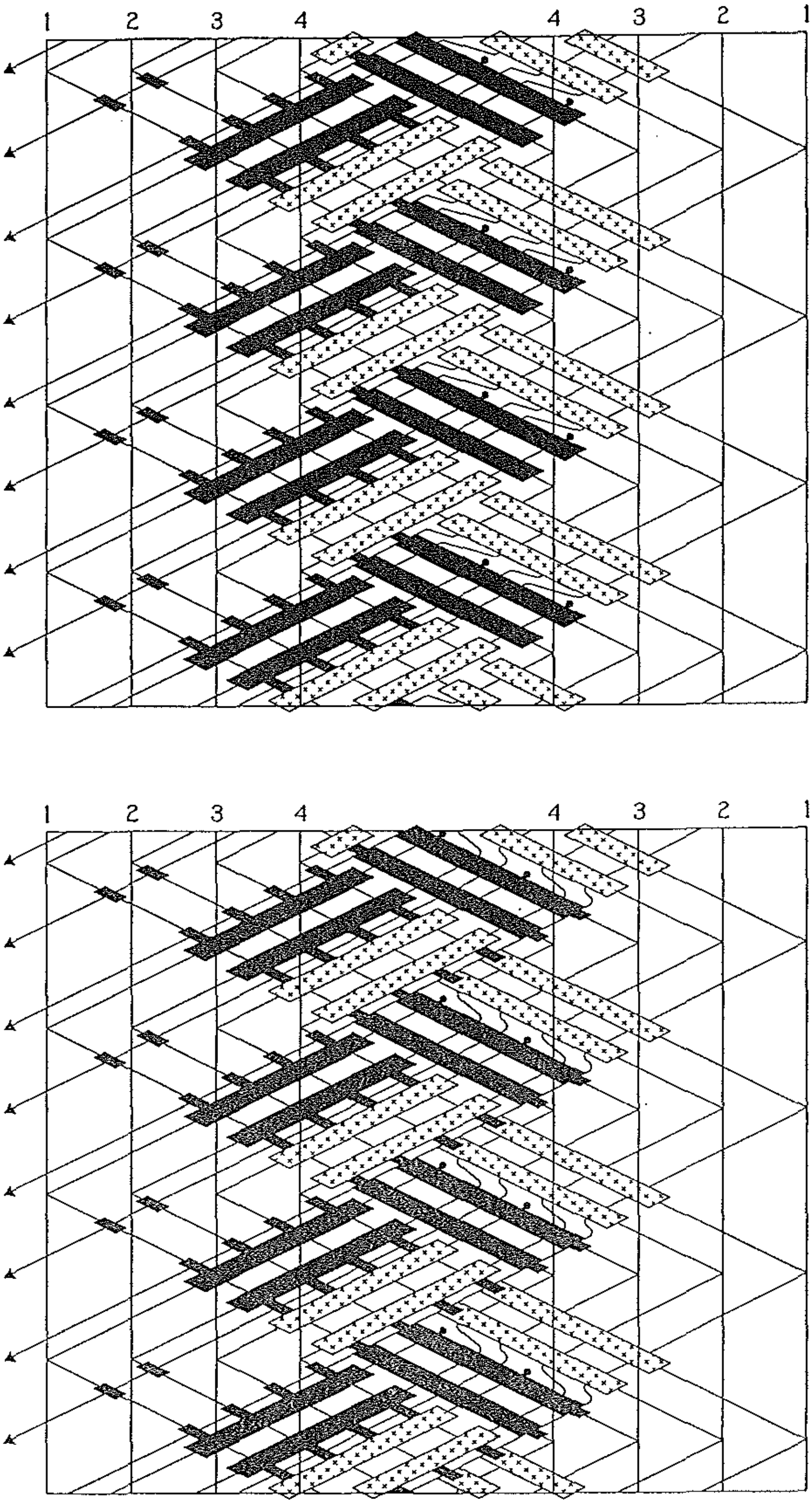

Fig. 850 — The 4-ply Tack Knot.

After the 4-ply Tack Knot has been finished, we braid a $p/b = 10/12$ two-pass Herringbone Knot, using two cords of a different colour. This two-pass Herringbone Knot covers the stem immediately below the thimble and rests hard agains it after it has been properly tightened by removing any slack in the two essential cords. These two cords pass, at their midpoints, between the two 4-string Round Braid ends immediately above their point of joining. The braiding procedure for this two-pass Herringbone Knot is the one discussed in *The Braider*, Issue No. 46, pp. 1091-1098. The details of the $p/b = 10/12$ two-pass two-colour Herringbone Knot and the algorithm diagrams for the two options in which to braid it are shown in Fig. 851.

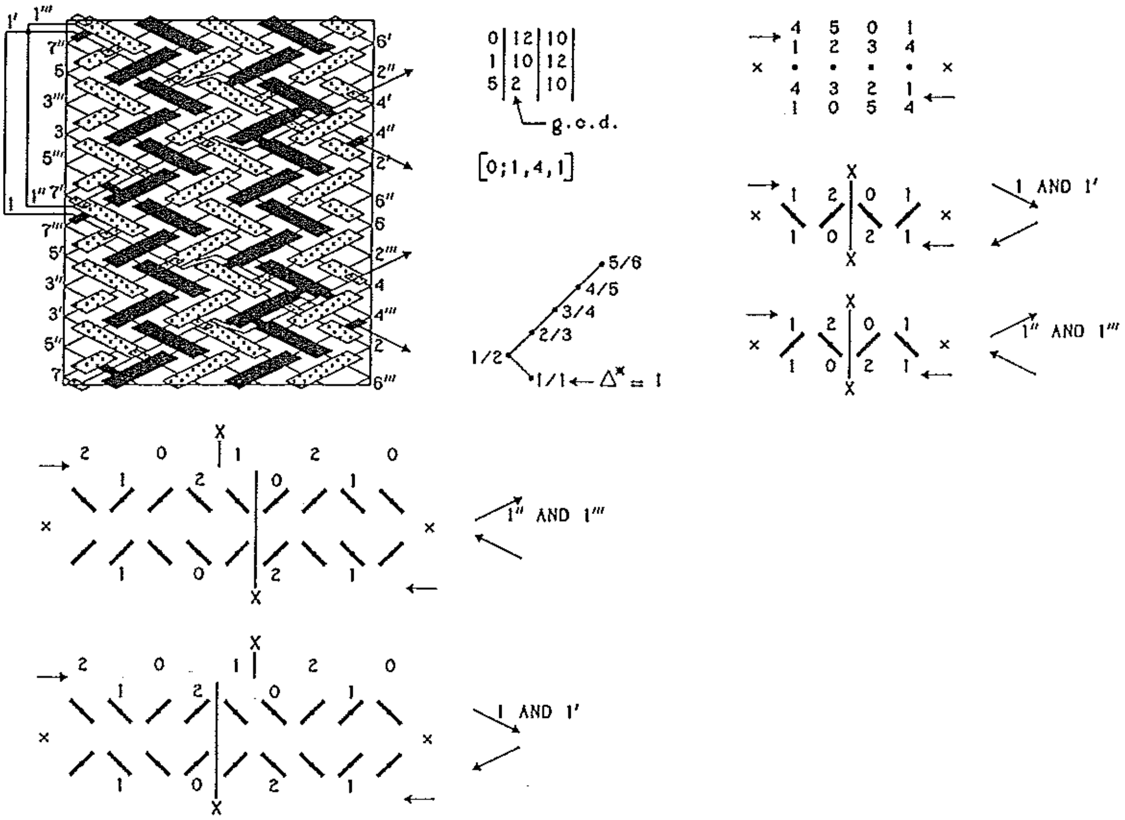

Fig. 851 — The two-pass two-colour Herringbone Knot.

In option 1 we first braid component 1, that is the half-cycles $1-2-3-\cdots-5-6-7$ and $1'-2'-3'-\cdots-5'-6'-7'$ by parallel braiding. Then we braid component 2, that is the half-cycles $1''-2''-3''-\cdots-5''-6''-7''$ and $1'''-2'''-3'''-\cdots-5'''-6'''-7'''$ by parallel braiding. From the algorithm diagram of the first component (the component with the initial half-cycles 1 and $1'$ from upper-left to lower-right) we read the following half-cycle braiding algorithms:

half-cycles:
$1\ \&\ 1'$: : $L \longrightarrow R$: Free run.
$2\ \&\ 2'$: $i = 0$; o for $i = 0$ left of X–X: $L \longleftarrow R$: o.
$3\ \&\ 3'$: $i = 0$; : $L \longrightarrow R$: o.
$4\ \&\ 4'$: $i \leq 1$; o for $i = 1$ left of X–X: $L \longleftarrow R$: $3o$.
$5\ \&\ 5'$: $i \leq 1$; : $L \longrightarrow R$: $2o - u$.
$6\ \&\ 6'$: $i \leq 2$; o for $i = 2$ left of X–X: $L \longleftarrow R$: $o - u - o - u$.
$7\ \&\ 7'$: $i \leq 2$; : $L \longrightarrow R$: $o - 3u$.

Option 1 gives for the second component (the component with the initial half-cycles

$1''$ and $1'''$ from lower-left to upper-right) the following half-cycle braiding algorithms:
half-cycles:
$1''$ & $1'''$: u for uppermost $i < 2$ left of lower X line and
u for uppermost $i = 2$ adjacent left bight-boundary and
$\star - o = 2o$ for uppermost $i = 2$ right of both X lines:
$L \longrightarrow R$: $3u - 2o - u$.
$2''$ & $2'''$: $i = 0$; o for $i = 0$ left of lower X line:
$L \longleftarrow R$: $u - o - u - 2o - u$.
$3''$ & $3'''$: $i = 0$; $o - \star = 2o$ for uppermost $i = 0$ left of upper X line and:
$\star - o = u - o$ for uppermost $i = 0$ right of upper X line:
$L \longrightarrow R$: $u - 2o - u - 2o - u - o$.
$4''$ & $4'''$: $i \leq 1$; o for $i = 1$ left of lower X line:
$L \longleftarrow R$: $u - 2o - u - 3o - u$.
$5''$ & $5'''$: $i \leq 1$; $\star - o = u - o$ for uppermost $i = 1$ right of upper X line:
$L \longrightarrow R$: $u - 2o - u - 3o - 2u$.
$6''$ & $6'''$: $i \leq 2$; o for $i = 2$ left of lower X line:
$L \longleftarrow R$: $u - 2o - 2u - 2o - 2u$.
$7''$ & $7'''$: $i \leq 2$; u for uppermost $i < 2$ right of lower X line and
$o - \star = o - u$ for uppermost $i = 2$ left of both X lines and
$u - \bullet$ for uppermost $i = 2$ right of both X lines:
$L \longrightarrow R$: $o - u - 2o - 4u - \bullet - 2u$.

In option 2 we first braid component 1, that is the half-cycles $1'' - 2'' - 3'' - \cdots - 5'' - 6'' - 7''$ and $1''' - 2''' - 3''' - \cdots - 5''' - 6''' - 7'''$ by parallel braiding. Then we braid component 2, that is the half-cycles $1 - 2 - 3 - \cdots - 5 - 6 - 7$ and $1' - 2' - 3' - \cdots - 5' - 6' - 7'$ by parallel braiding. From the algorithm diagram of the first component (the component with the initial half-cycles $1''$ and $1'''$ from lower-left to upper-right) we read the following half-cycle braiding algorithms:
half-cycles:
$1''$ & $1'''$: : $L \longrightarrow R$: Free run.
$2''$ & $2'''$: $i = 0$; o for $i = 0$ left of X–X: $L \longleftarrow R$: o.
$3''$ & $3'''$: $i = 0$; : $L \longrightarrow R$: o.
$4''$ & $4'''$: $i \leq 1$; o for $i = 1$ left of X–X: $L \longleftarrow R$: $3o$.
$5''$ & $5'''$: $i \leq 1$; : $L \longrightarrow R$: $2o - u$.
$6''$ & $6'''$: $i \leq 2$; o for $i = 2$ left of X–X: $L \longleftarrow R$: $o - u - o - u$.
$7''$ & $7'''$: $i \leq 2$; : $L \longrightarrow R$: $o - 3u$. .

Option 2 gives for the second component (the component with the initial half-cycles 1 and $1'$ from upper-left to lower-right) the following half-cycle braiding algorithms:
half-cycles:
1 & $1'$: u for uppermost $i < 2$ left of lower X line and
u for uppermost $i = 2$ adjacent left bight-boundary and
$\star - o = u - o$ for uppermost $i = 2$ right of both X lines:
$L \longrightarrow R$: $2u - o - u - 2o$.
2 & $2'$: $i = 0$; o for $i = 0$ left of lower X line:
$L \longleftarrow R$: $o - u - 2o - u - o$.
3 & $3'$: $i = 0$; $o - \star = o - u$ for uppermost $i = 0$ left of upper X line and:
$\star - o = 2o$ for uppermost $i = 0$ right of upper X line:
$L \longrightarrow R$: $2o - u - 2o - u - 2o$.

$4\,\&\,4' : i \le 1$; o for $i = 1$ left of lower X line:
$L \longleftarrow R$: $2o - u - 2o - u - 2o$.
$5\,\&\,5' : i \le 1$; $o - \star = 2o$ for uppermost $i = 1$ left of upper X line:
$L \longrightarrow R$: $2o - u - 3o - 2u - o$.
$6\,\&\,6' : i \le 2$; o for $i = 2$ left of lower X line:
$L \longleftarrow R$: $2o - 2u - 2o - 2u - o$.
$7\,\&\,7' : i \le 2$; u for uppermost $i < 2$ right of lower X line and
$o - \star = 2o$ for uppermost $i = 2$ left of both X lines and
$u - \bullet$ for uppermost $i = 2$ right of both X lines:
$L \longrightarrow R$: $3o - 5u - \bullet - 2u$.

The coding which is associated with the • crossing can be freely chosen, however, it is convenient to take for this coding the one which simplifies braiding. Hence in option 1 we would braid the half-cycles $7''$ & $7'''$ as $o - u - 2o - 7u$, and in option 2 we would braid the half-cycles 7 & $7'$ as $3o - 8u$.

Finally we braid a three-pass $p/b = 7/10$ Spanish Ring Knot with the cord which passes diametrically through the stem (see pg. 1100). Say we braid this knot by the parallel braiding method.[†] Its grid-diagram and algorithm diagram are shown in Fig. 852.

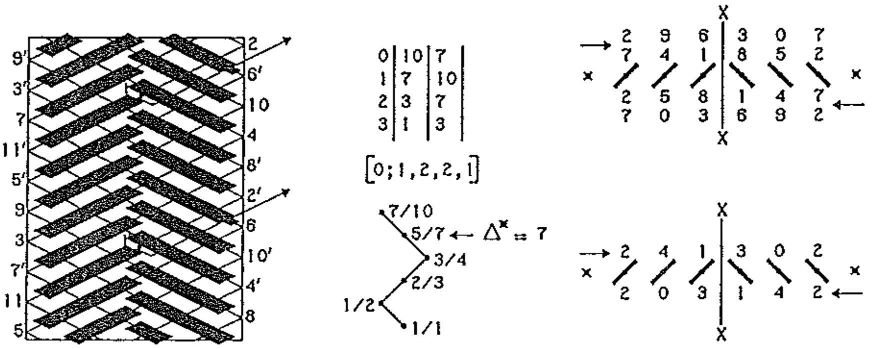

Fig. 852 — The three-pass $p/b = 7/10$ Spanish Ring Knot.

From its algorithm diagram we read the following half-cycle braiding algorithms:

half-cycles 1 & 1′ :		:	$L \longrightarrow R$:	Free run.
half-cycles 2 & 2′ :	$i = 0$;	$i \neq 0$ left of X–X :	$L \longleftarrow R$:	Free run.
half-cycles 3 & 3′ :	$i = 0$;	:	$L \longrightarrow R$:	u.
half-cycles 4 & 4′ :	$i \le 1$;	$i \neq 1$ left of X–X :	$L \longleftarrow R$:	$o - u$.
half-cycles 5 & 5′ :	$i \le 1$;	:	$L \longrightarrow R$:	$o - u$.
half-cycles 6 & 6′ :	$i \le 2$;	$i \neq 2$ left of X–X :	$L \longleftarrow R$:	$2o - u$.
half-cycles 7 & 7′ :	$i \le 2$;	:	$L \longrightarrow R$:	$2o - 2u$.
half-cycles 8 & 8′ :	$i \le 3$;	$i \neq 3$ left of X–X :	$L \longleftarrow R$:	$2o - 2u$.
half-cycles 9 & 9′ :	$i \le 3$;	:	$L \longrightarrow R$:	$2o - 3u$.
half-cycles 10 & 10′ :	$i \le 4$;	$i \neq 4$ left of X–X :	$L \longleftarrow R$:	$3o - 3u$.
half-cycles 11 & 11′ :	$i \le 4$;	unders right of X–X :	$L \longrightarrow R$:	$3o - 3u$.

Ensure that all braidwork has been properly tightened, then put the free ends of the cords under tension before cutting off their excess lengths in order for the ends of the cords to pull back under the braid and hence to be properly hidden from view.

[†] Refer to *The Braider*, Issue No. 41, pp. 973-975.

Monkey's Fists

The Monkey's Fists are dealt with in many books on knots, and as usual one has copied the story from another without giving it much or even any thought. Even *The Ashley Book of Knots* forms no exception.

A Monkey's Fist is a single string knot of three sets of n parallel loops each with the three sets perpendicular to each other. We shall in our general discussion take $n = 4$.

Hence the string-run must pass from one set of n parallel loops to the next set of n parallel loops and consequently the knot must contain two transitions. The four 4-ply transition forms are shown by the left-hand column in Fig. 853.

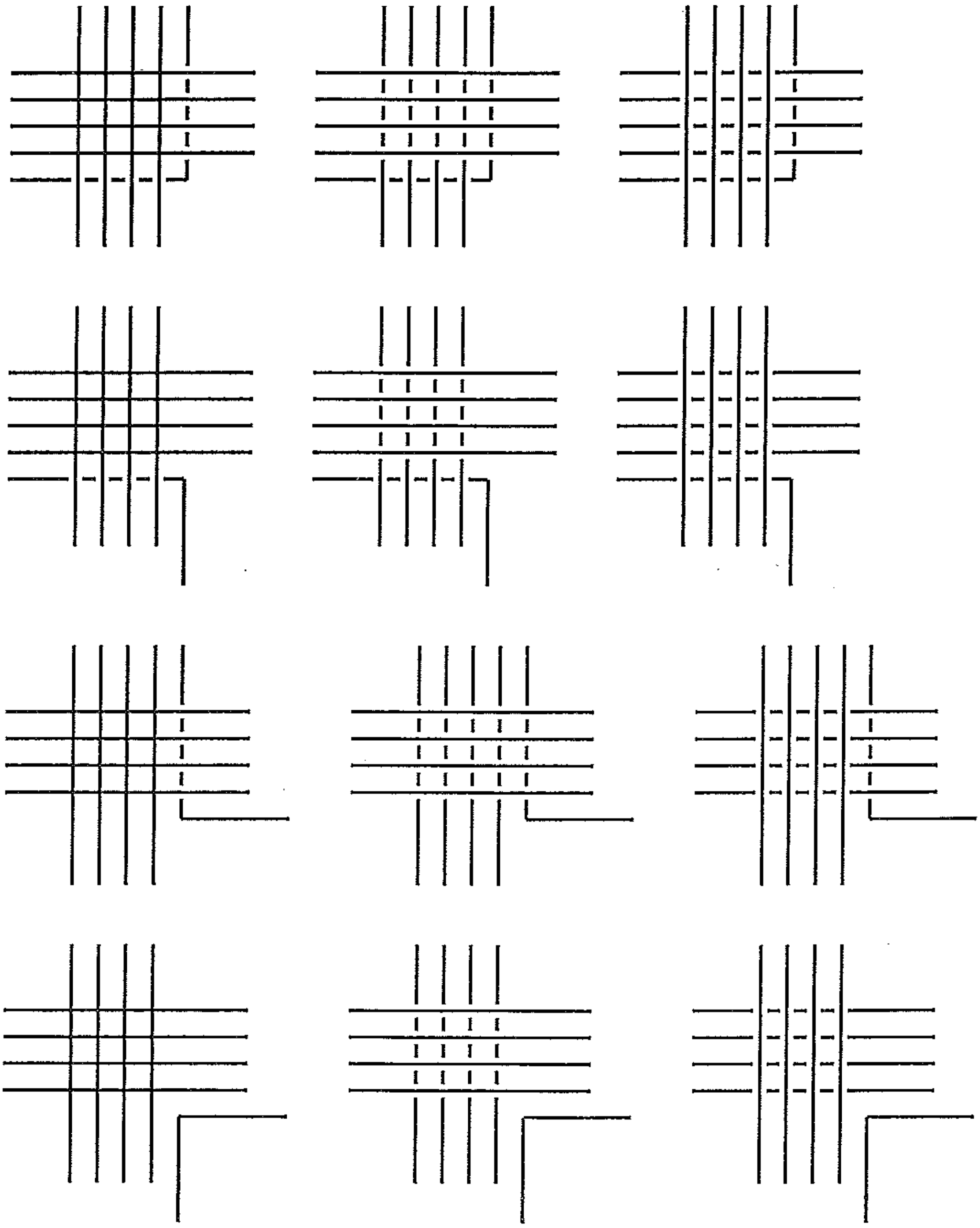

Fig. 853 — The four 4-ply transition forms.

Each of these transition forms is associated with the two coding forms shown at their right. With these coding forms we build the twelve transition sets in Fig. 855, each of which contains two similar transition forms, an essential requirement for a **regular** Monkey's Fist. For a good regular Monkey's Fist each transition form should be hidden within the braid and we should be able to join the string-ends diagonally over a crossing-point. The transition sets 2, 2A, 5 and 5A of Fig.855 don't fulfil the diagonally joining requirement for the string-ends. Furthermore, the diagonally joining of the string-ends should take place over a crossing-point which contains a transition, which requirement is not fulfilled by the transition sets 3, 3A, 6 and 6A. This leaves us with the four good transition sets 1, 1A, 4 and 4A for the regular Monkey's Fists. Of these four Monkey's Fists only the ones with the transition sets 1A or 4A of Fig. 855, with the arrows as indicated, and the ones with the transition sets 1 or 4 of Fig. 855, with the arrows reversed to those indicated, are of practical value since they are the easiest to braid. A 4-ply Monkey's Fist containing the transition set 1A of Fig. 855 is shown in Fig. 854.

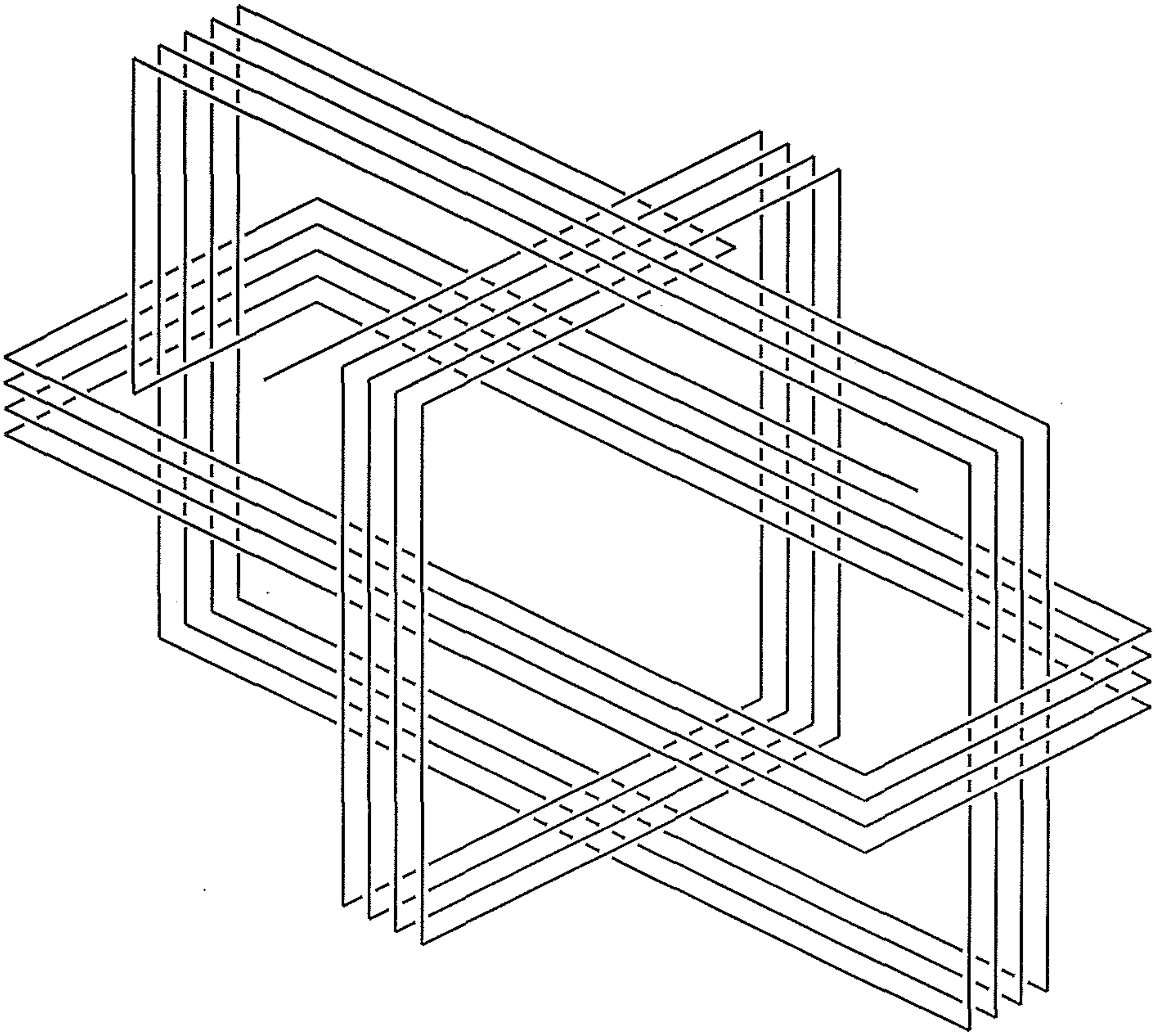

Fig. 854 — A 4-ply Monkey's Fist containing transition set 1A.

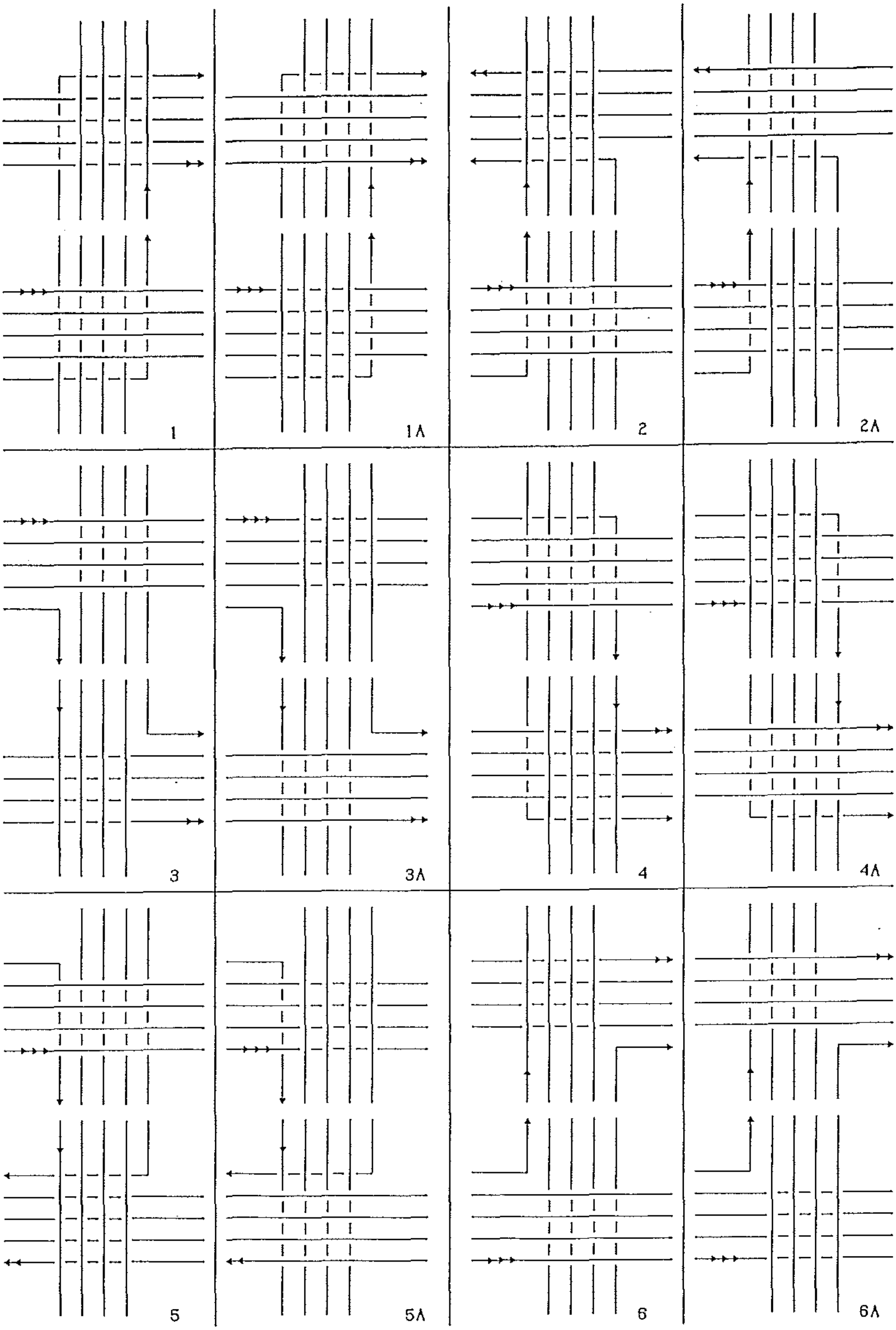

Fig. 855 — The twelve regular transition sets.

The Monkey's Fist of Ashley #2202 (resulting from the common sailor's method of construction) has the transition set 3A of Fig. 855, and hence is not a good regular Monkey's Fist. Note that Ashley #2202 is identical to Ashley #2200 (see Fig. 856).

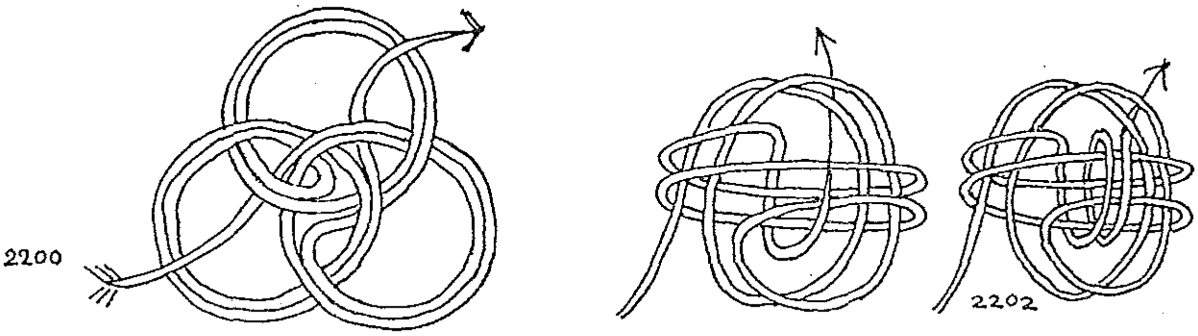

Fig. 856 — Ashley #2200 and #2202.

The associated 4-ply form is shown in Fig. 857.

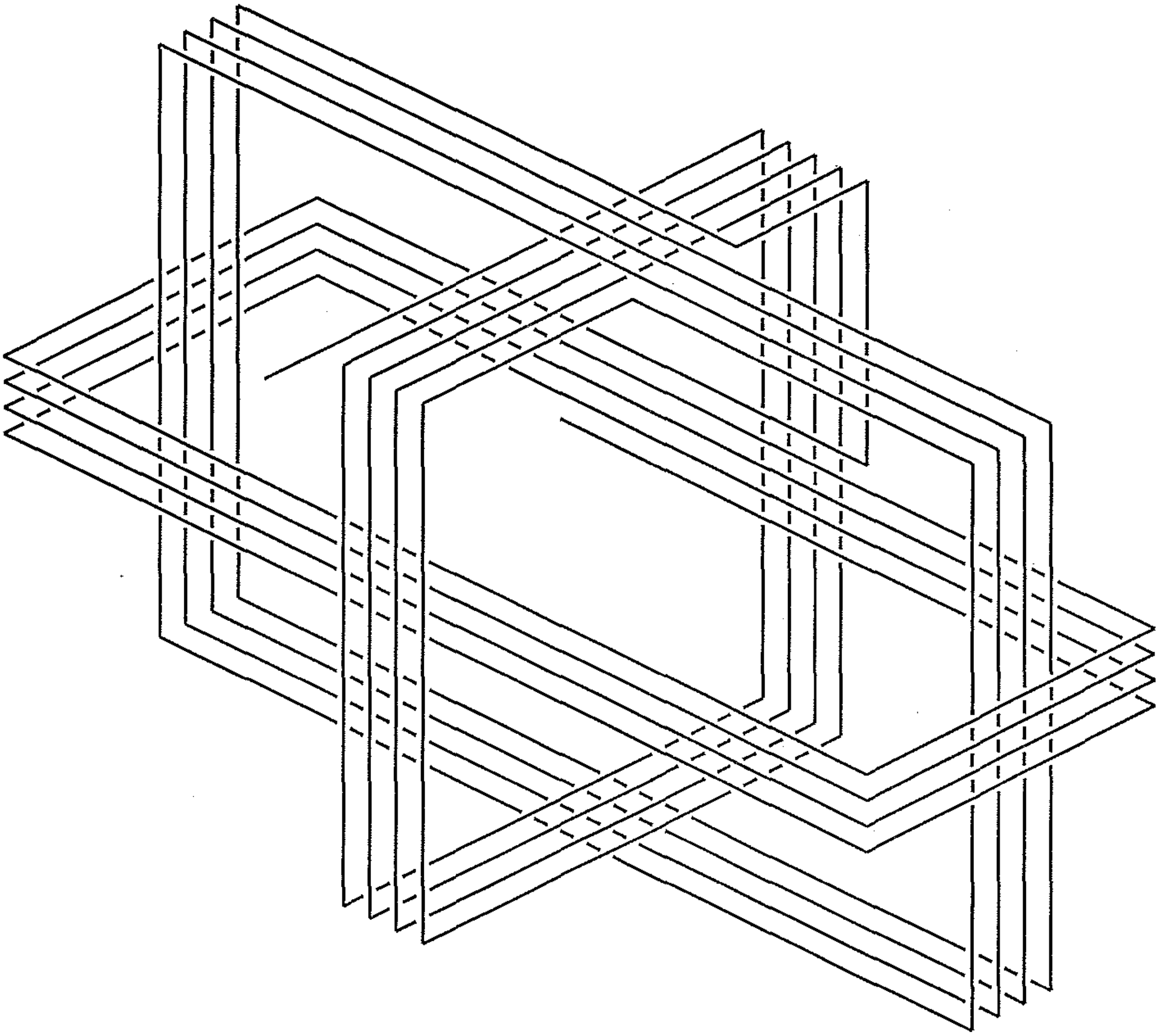

Fig. 857 — A 4-ply Monkey's Fist containing transition set 3A.

The Monkey's Fist of Ashley #2201 (see Fig. 858) does not contain a regular transition set, hence is not a regular Monkey's Fist.

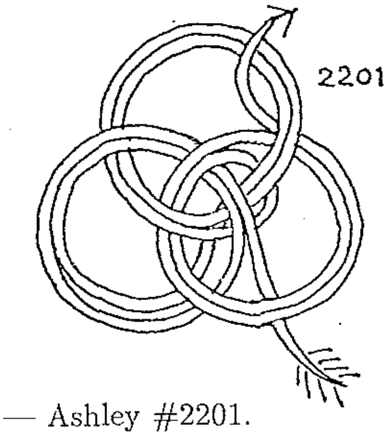

Fig. 858 — Ashley #2201.

The associated 4-ply form is shown in Fig. 859.

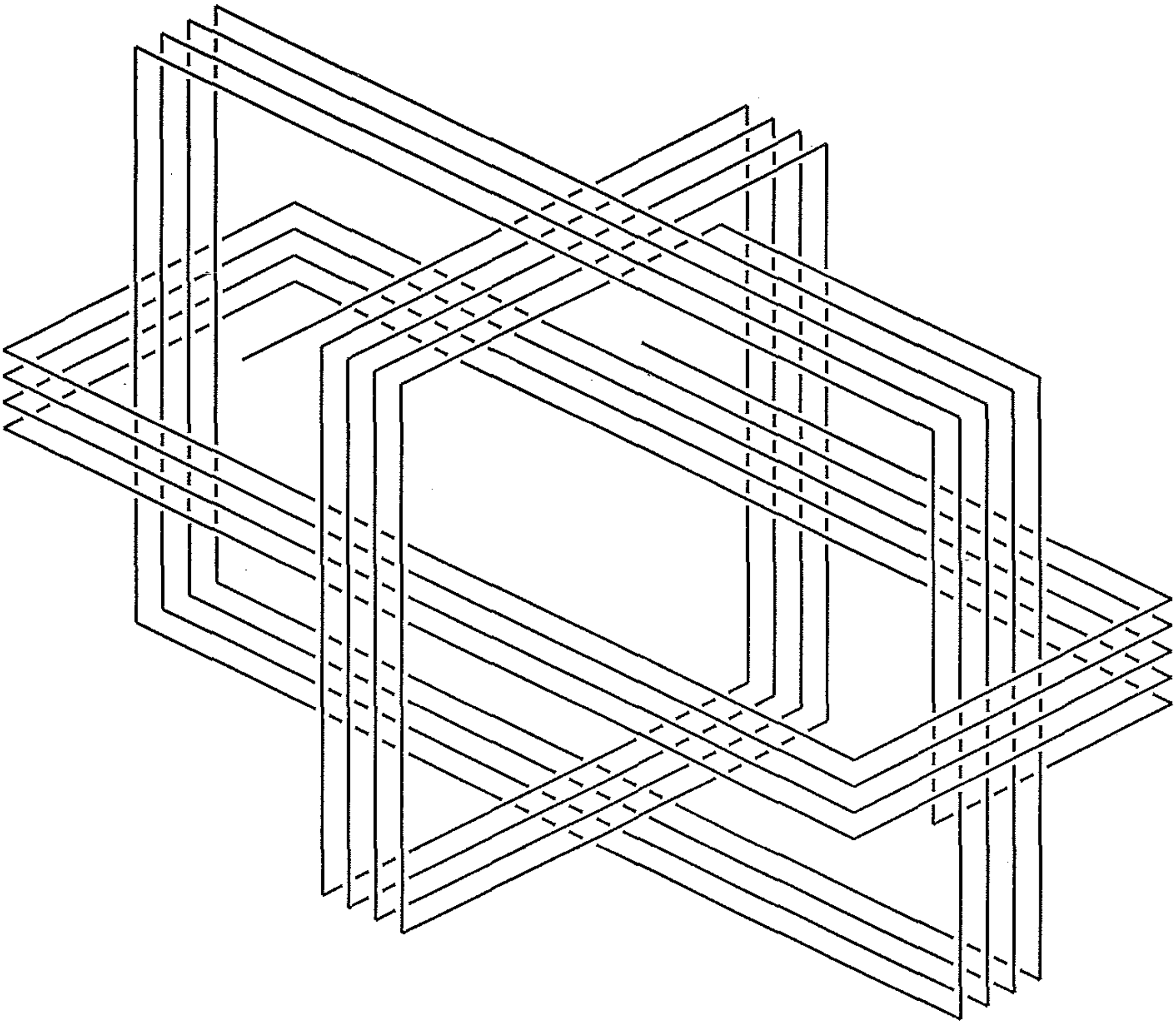

Fig. 859 — The 4-ply Monkey's Fist associated with Ashley #2201.

The Monkey's Fist of Ashley #2205 (see the three leftmost figures in Fig. 860) does not contain a regular transition set, hence is not a regular Monkey's Fist.

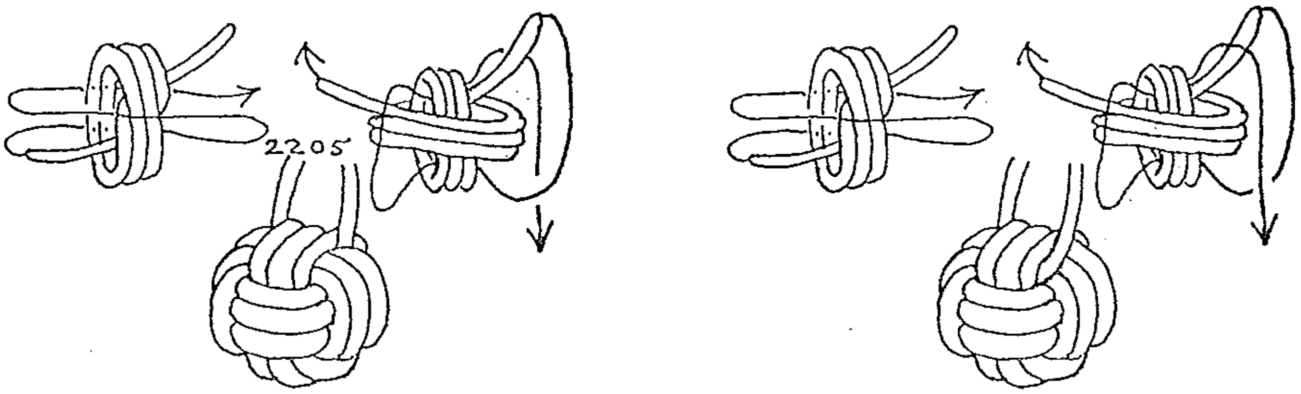

Fig. 860 — Ashley #2205 and its rectified form.

The associated 4-ply form is shown in Fig. 861.

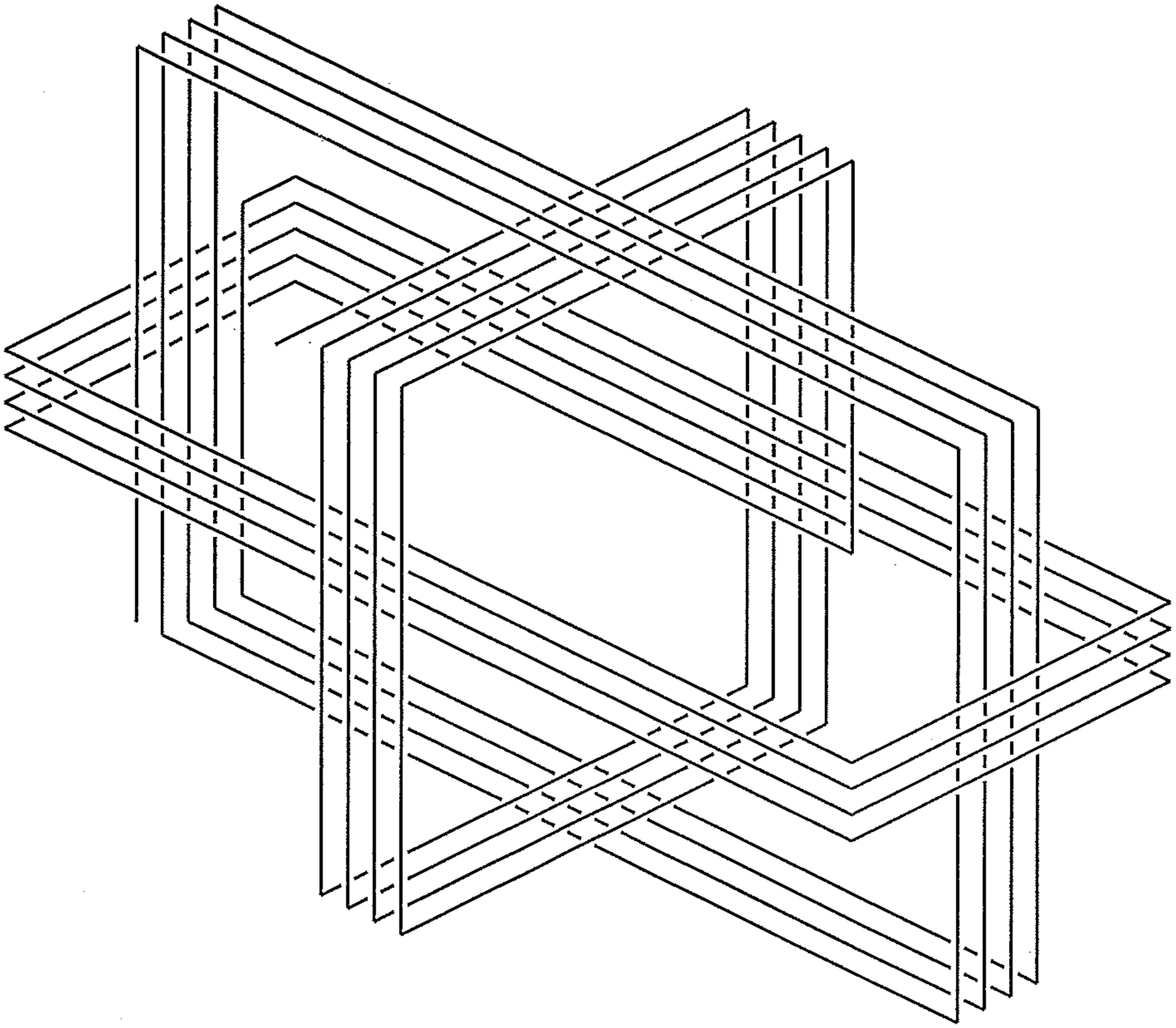

Fig. 861 — The 4-ply Monkey's Fist associated with Ashley #2205.

The Monkey's Fist in Ashley #2205 can readily be modified into a good regular Monkey's Fist by changing the string-run in its upper-right figure to the string-run in the upper-rightmost figure of Fig. 860. The resulting Monkey's Fist is then a good regular one containing the transition set 1A of Fig. 855 (it thus becomes the 2-ply form of Fig. 854). It is interesting to note that there seem to be no publications which contain a good regular Monkey's Fist; they all fail by either not having a **regular** transition set and/or by not having the desired joining of the string-ends. Note also that transition sets 1, 1A, 4 and 4A are the only ones in which each transition is properly hidden.

Round Bihelix Braids

In *The Braider*, Issue No. 17, pg. 378, we introduced the Regular Cylindrical Bihelix Braids and discussed how they were derived from Round Bihelix Braids. The weaving pattern in a Round Bihelix Braid always has a spiral effect, and hence creates with strings of different colour a spiralling colour pattern. Furthermore, Round Bihelix Braids not only enable us to construct Round Braids with an even number of strings, but also enable us to construct Round Braids with an odd number of strings, which is often important when further integrated knots require an odd number of strings. Although a Round Bihelix Braid will always have a spiralling pattern, the spiralling effect can be disguised by twisting the braid when the difference between the number of left-helix strings and right-helix strings is small.[†]

When in the $[n_l, n_r]$ Round Bihelix Braid[‡] $n_l < n_r$, the braid has a left helix with a helix angle of $(45° - arctan\frac{n_l}{n_r})$, and when $n_l > n_r$, the braid has a right helix with a helix angle of $(arctan\frac{n_l}{n_r} - 45°)$.

Fig. 862 depicts Ashley's five-strand square sinnet #3013 on page 496 of *The Ashley Book of Knots*. This Round Bihelix Braid of 5-strings with $[n_l, n_r] = [2, 3]$ is more or less half-round in cross-section and the braid has a left-helix with an angle of $(45° - arctan\frac{2}{3}) = (45° - 33.69°) = 11.31°$. We braid this braid as indicated by the rightmost diagram in Fig. 862, hence 1 around the back from right to left, then $2u - o$ along the front from left to right; next 2 around the back from left to right, then $u - o$ along the front from right to left; continue with these two braiding sequences, hence next 3 around the back from right to left, then $2u - o$ along the front from left to right; next 4 around the back from left to right, then $u - o$ along the front from right to left, and so on. If we want to disguise the left helix in the braid, we turn the braid anti-clockwise through an angle of $11.31°$.

Fig. 863 depicts the same [2, 3] Round Bihelix Braid but where string 3 only differs in colour from the other four strings.

[†] It is important to realise that a Round Bihelix Braid always has a spiralling pattern when braided properly. Many braiders fail to keep that in mind, especially when the difference between the number of left-helix strings and right-helix strings is small; even Ashley in his book fails to draw attention to this and consequently his drawings #3013 and #3014 on page 496, for example, are misleading.

[‡] Refer to *The Braider*, Issue No. 17, pp. 378-379, for the construction process of its associated string-run diagram.

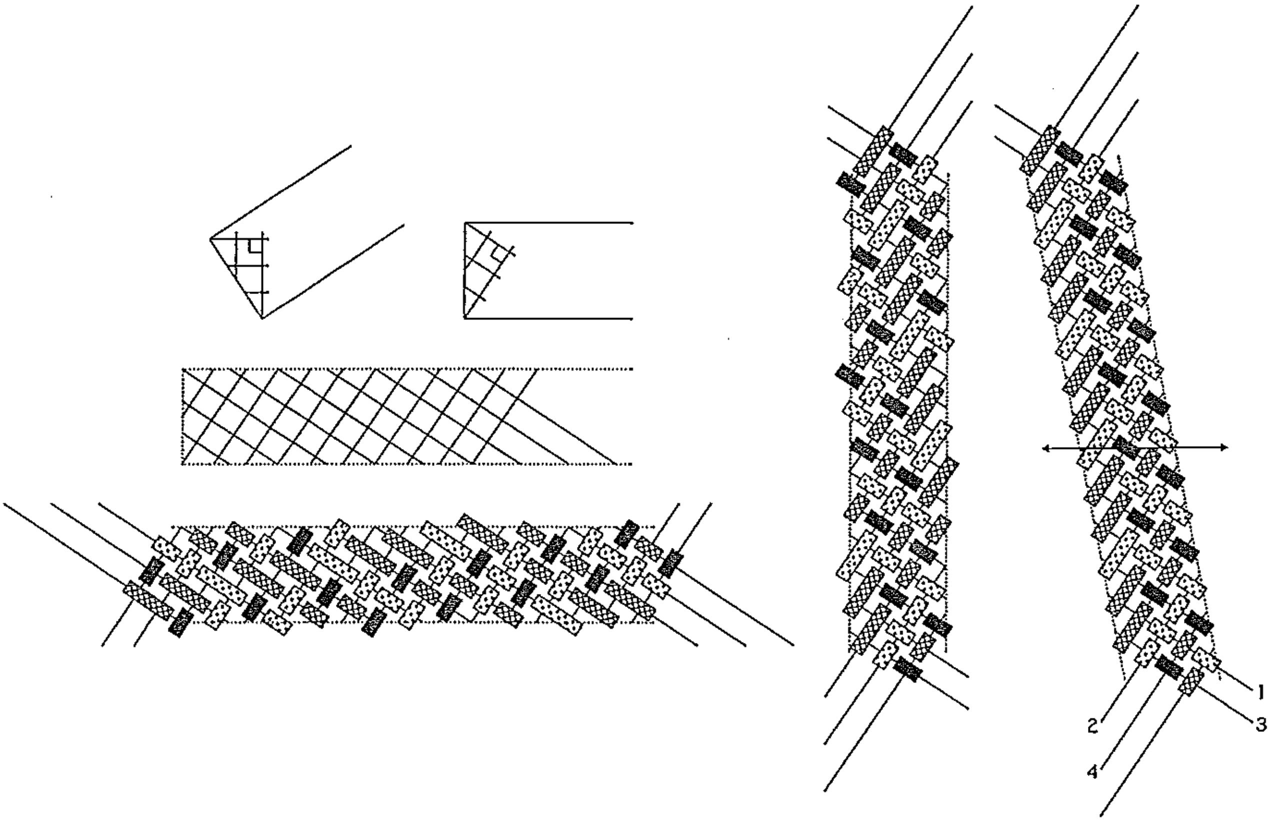

Fig. 862 — A 5-string Round Bihelix Braid with $[n_l, n_r] = [2, 3]$.

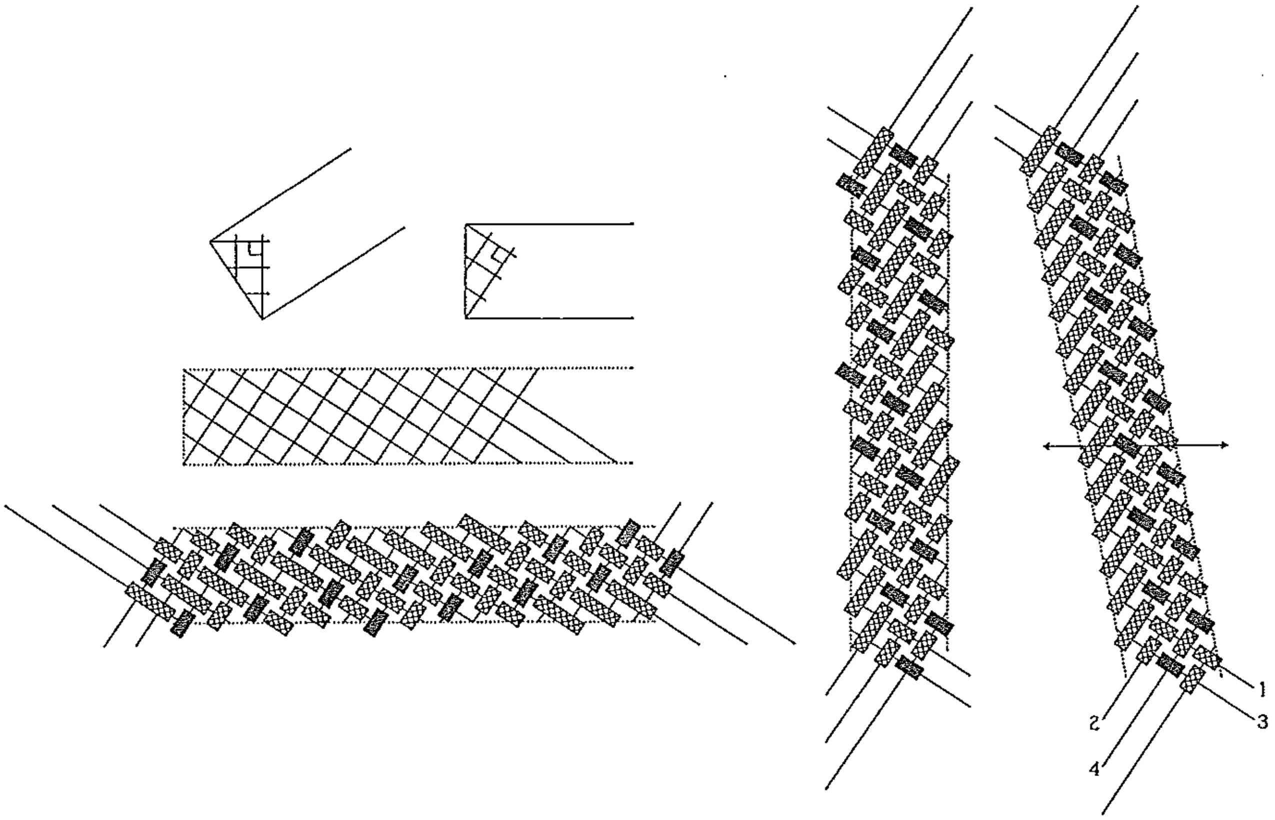

Fig. 863 — A 5-string Round Bihelix Braid with $[n_l, n_r] = [2, 3]$.

We like to stress again that the braider should be aware of the fact that the braids in Figs. 862 & 863 have a spiralling pattern when braided properly. This will readily be overlooked since the helix angle of this spiralling braid, when braided properly, is only 11.31°, and as mentioned above, the spiralling pattern created can readily be disguised, knowingly or unknowingly, by twisting the braid anti-clockwise through an angle of 11.31° or by not braiding it properly.

In the Figs. 864 to 867 we show a few of the many patterns which can be designed for Round Bihelix Braids:

In Fig. 864 is depicted a 9-string [4, 5] Round Bihelix Braid in which the colour of the four left-helix strings differs from the colour of the five right-helix strings. When this Round Bihelix Braid has been braided properly, the colour-pattern will have a left-helix angle of $(45^\circ - arctan\frac{4}{5}) = (45^\circ - 38.66^\circ) = 6.34^\circ$, hence a small helix angle which can very easily be disguised. The lower-right grid-diagram in Fig. 864 indicates a succession of the following two braiding sequences for this Round Bihelix Braid:

(1). Take string 1 around the back from left to right, then from right to left along the front: $u - 2o - u$.

(2). Take string 2 around the back from right to left, then from left to right along the front: $2u - o - 2u$.

In Fig. 865 is depicted a 9-string [2, 7] Round Bihelix Braid in which the colour of the two left-helix strings differs from the colour of the seven right-helix strings. When this Round Bihelix Braid has been braided properly, the colour-pattern will have a left-helix angle of $(45^\circ - arctan\frac{2}{7}) = (45^\circ - 15.95^\circ) = 29.05^\circ$. The lower-right grid-diagram in Fig. 865 indicates a succession of the following two braiding sequences for this Round Bihelix Braid:

(1). Take string 1 around the back from left to right, then from right to left along the front: $u - o$.

(2). Take string 2 around the back from right to left, then from left to right along the front: $2u - o - 2u - o - u$.

In Fig. 866 is depicted a 12-string [2, 10] Round Bihelix Braid in which the colour of the strings alternates as shown in the grid-diagrams. When this Round Bihelix Braid has been braided properly, the left-helix angle of the braid $((45^\circ - arctan\frac{2}{10}) = (45^\circ - 11.31^\circ) = 33.69^\circ)$ will appear as a VV colour-pattern with a right-helix angle of $90^\circ - 33.69^\circ = 56.31^\circ$. The lower-right grid-diagram in Fig. 866 indicates a succession of the following two braiding sequences for this Round Bihelix Braid:

(1). Take string 1 around the back from left to right, then from right to left along the front: $2u$.

(2). Take string 2 around the back from right to left, then from left to right along the front: $2u - 2o - 2u - 2o - 2u$.

In Fig. 867 is depicted a 12-string [3, 9] Round Bihelix Braid. When this Round Bihelix Braid has been braided properly, the left-helix angle of the braid $((45^\circ - arctan\frac{3}{9}) = (45^\circ - 18.43^\circ) = 26.57^\circ)$ will appear as a colour pattern with a left-helix angle of $90^\circ - 26.57^\circ = 63.43^\circ$. The lower-right grid-diagram in Fig. 866 indicates a succession of the following two braiding sequences for this Round Bihelix Braid:

(1). Take string 1 around the back from left to right, then from right to left along the front: $2u - o$.

(2). Take string 2 around the back from right to left, then from left to right along the front: $u - 2o - u - 2o - u - 2o$.

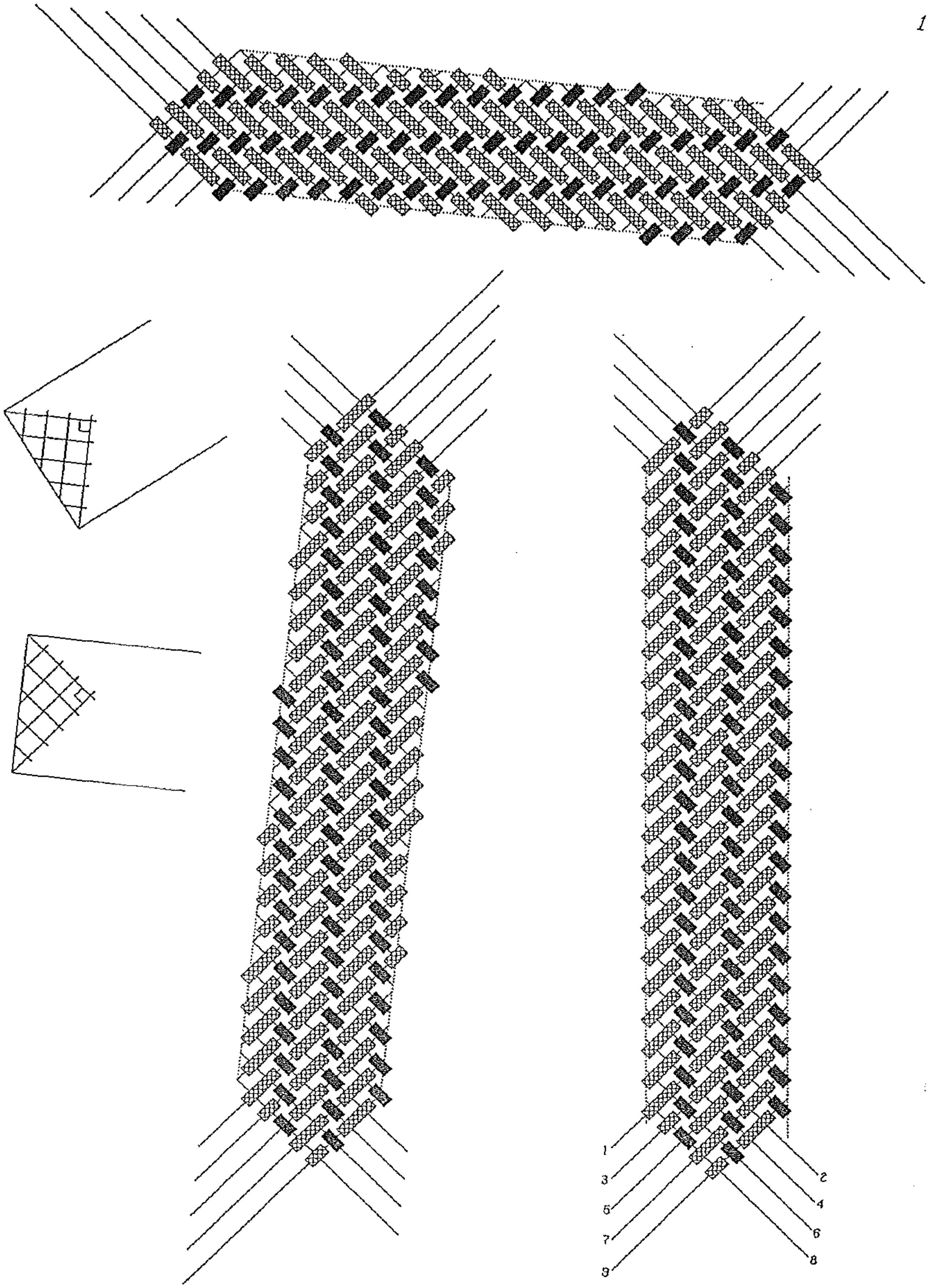

Fig. 864 — A 9-string [4, 5] Round Bihelix Braid.

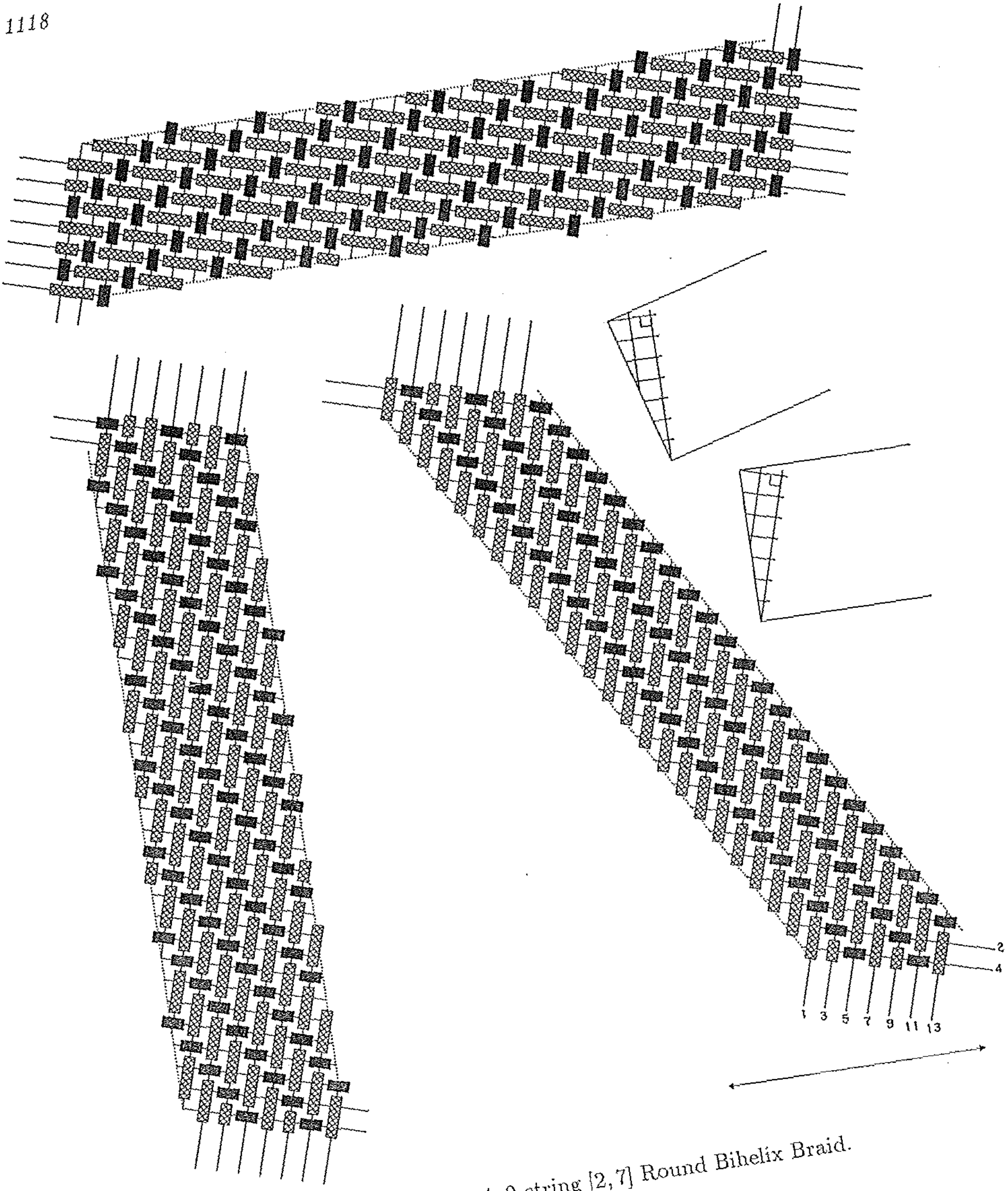

Fig. 865 — A 9-string [2, 7] Round Bihelix Braid.

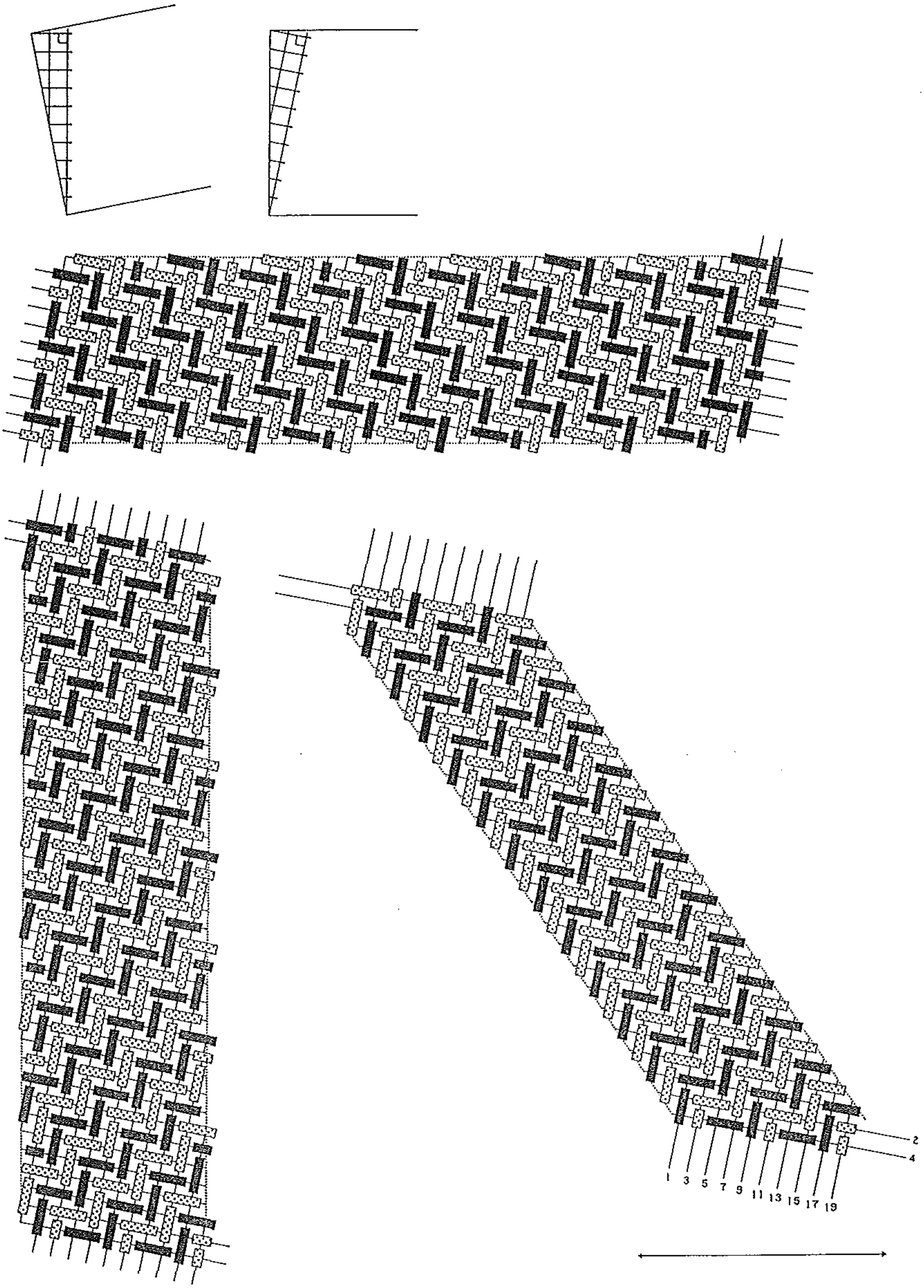

Fig. 866 — A 12-string [2, 10] Round Bihelix Braid.

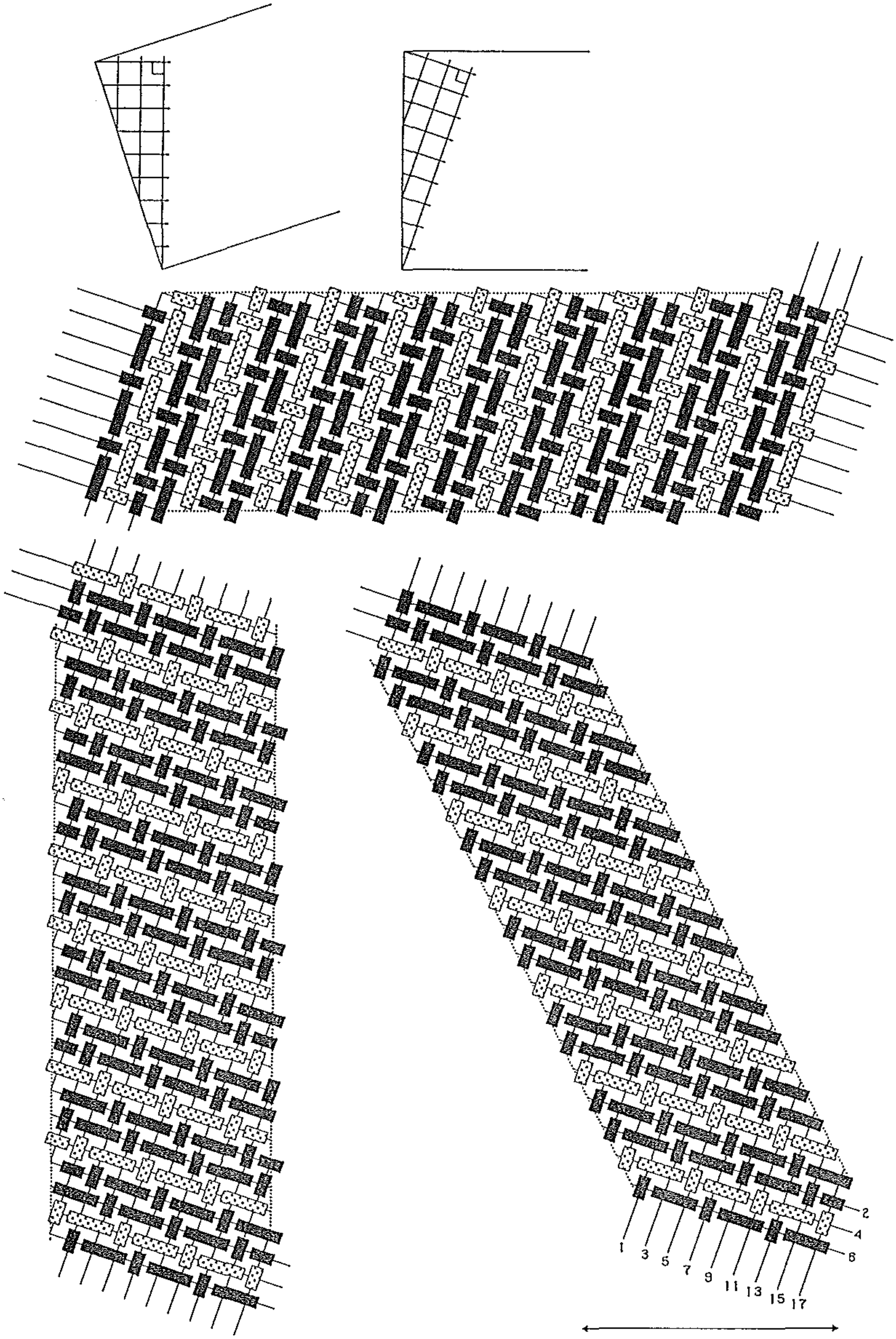

Fig. 867 — A 12-string [3, 9] Round Bihelix Braid.

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for
the braiding artisan

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A Braiding Project — Key-hanger No. 2

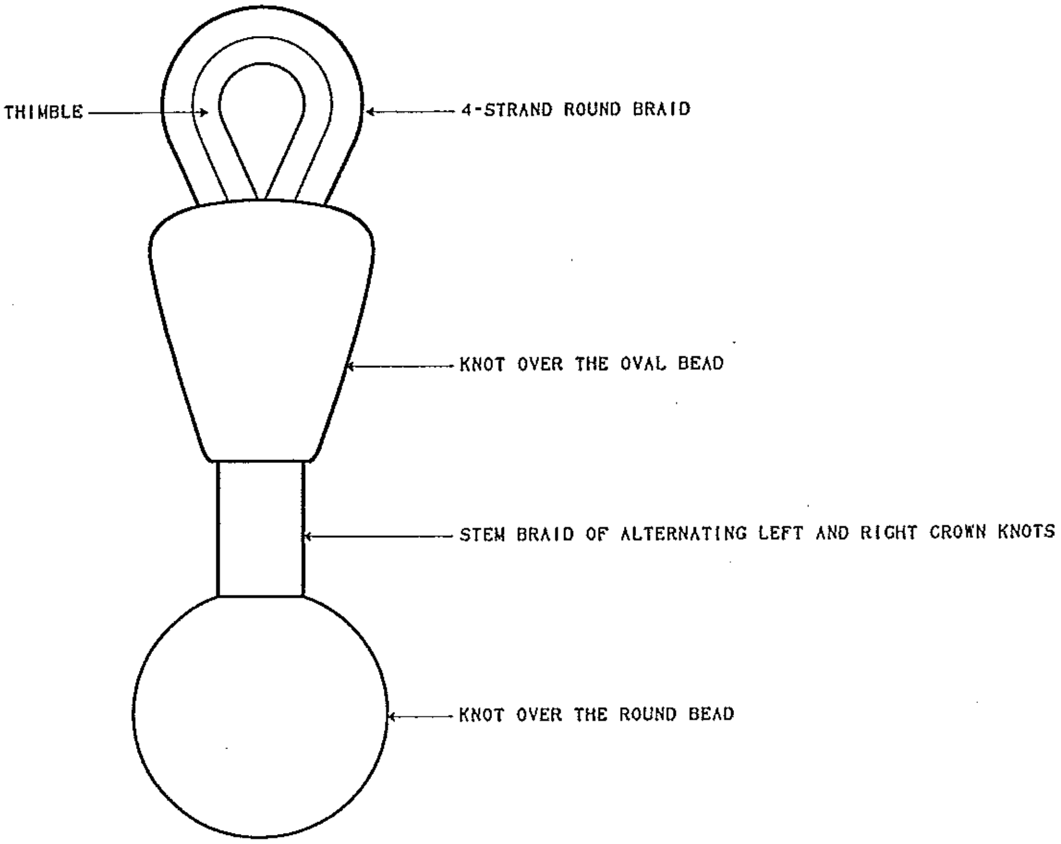


Fig. 868 — Key-hanger No. 2. Cord diameter 2 mm.

The braid forming the eye around the thimble of 25 mm. is a 4-cord under-over Round Braid[†] made at the centre of the cord lengths (cords approximately 50 cm. in length). Put this braid tightly around the thimble and secure both 'ends' with a Double Constrictor Knot[‡] immediately below the thimble.

Immediately below this constrictor knot start braiding the stem. The braid of the stem consists of a sequence of Crown Knots, one on top the other as shown in *The Braider*, Issue No. 47, pp. 1100-1101, Figs. 846 & 847.[††] The four strands of a Crown Knot have all the same colour while the colour of the four strands of the left Crown Knots differ from the colour of the four strands of the right Crown Knots.

Over the stem-braid we push a 26 mm. long oval bead whose hole we have enlarged to obtain a tight fit, and through which we have drilled diametrically a small hole through which a small brass nail will fit tightly. This oval bead is pushed up to the point of the thimble and secured in place by means of a small brass nail through the diametrically drilled hole in the bead. The ends of the small brass nail are filed flush with the bead. Then carefully paint the oval bead so that its colour becomes the colour of the knot which we will place over it. The grid-diagram of this knot is depicted in Fig. 869 (left bight-edge towards thimble).

[†] See *The Braider*, Issue No. 47, pg. 1099, Fig. 844.

[‡] See *The Braider*, Issue No. 47, pg. 1100, Fig. 845.

[††] The braid of the stem is *Ashley #2938.* Note that the pictorial sketch in *The Ashley Book of Knots* gives the wrong impression of this braid and neither is the there stated construction procedure clear. The braid has in fact the appearance of a $2u-2o$ 16-strand Round Braid.

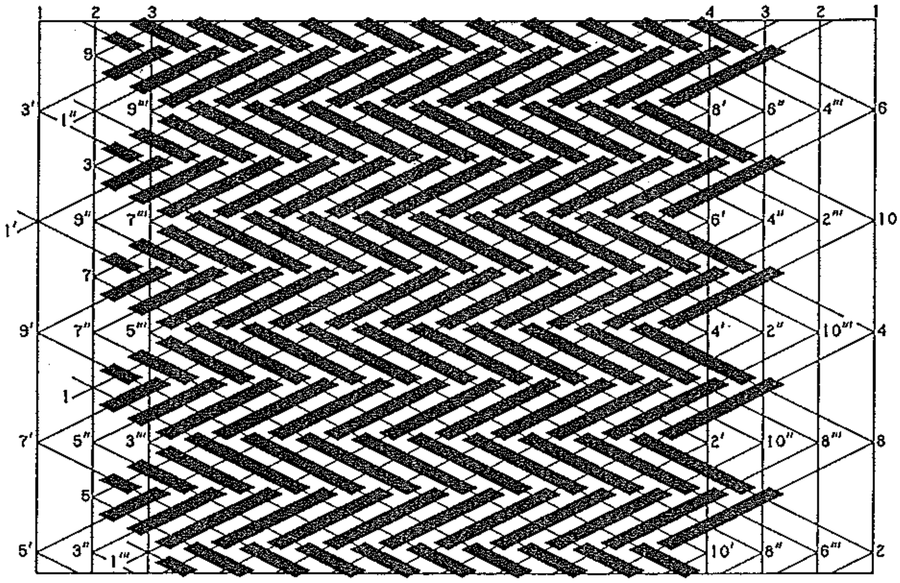


Fig. 869 — The knot over the oval bead.

This knot (which is a Nested Cylindrical Braid) has the string-run specification $(22/20/222)\{1_1 2_4 3_3 2_2/4_1 1_2 2_3 3_4\}20$. It consists of four under–over coded components: one with 7-parts, between the bight-boundaries $2 \longleftrightarrow 1$, and three with 6-parts each, between the respective bight-boundaries $1 \longleftrightarrow 4$, $2 \longleftrightarrow 3$ and $3 \longleftrightarrow 2$.

We can braid this knot in several ways, for example as indicated in Fig. 870.

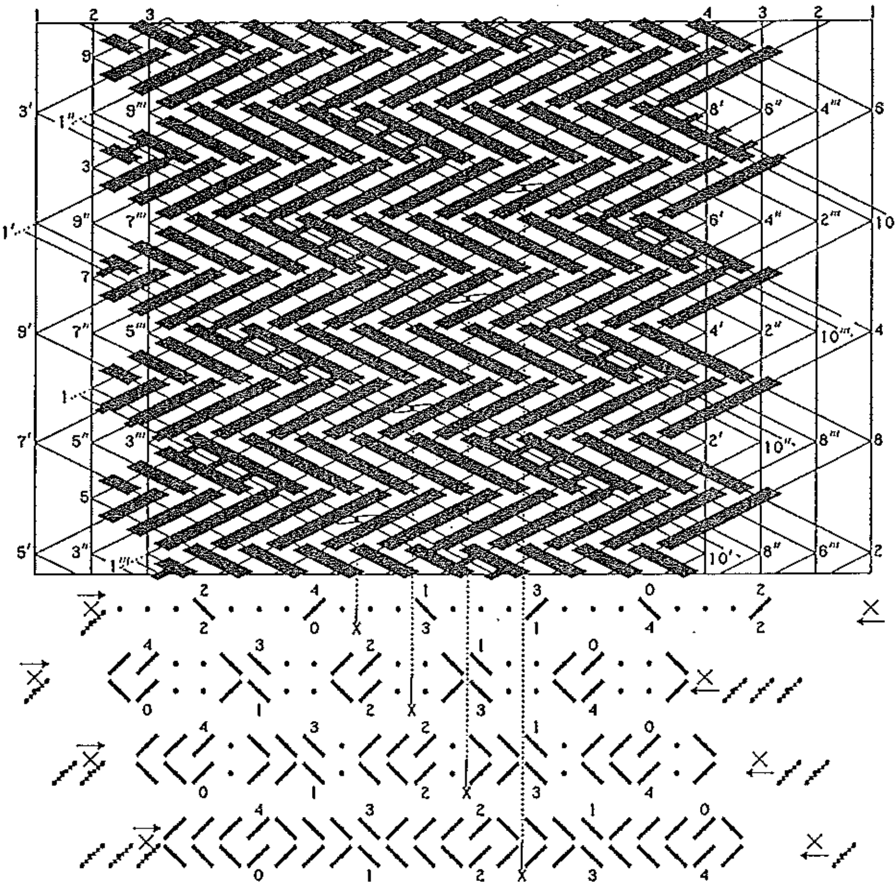


Fig. 870 — The knot over the oval bead.

Instead of using the grid-diagram in Fig. 870 we can use the grid-diagram in Fig. 871 which is akin to the grid-diagram in Fig. 869.

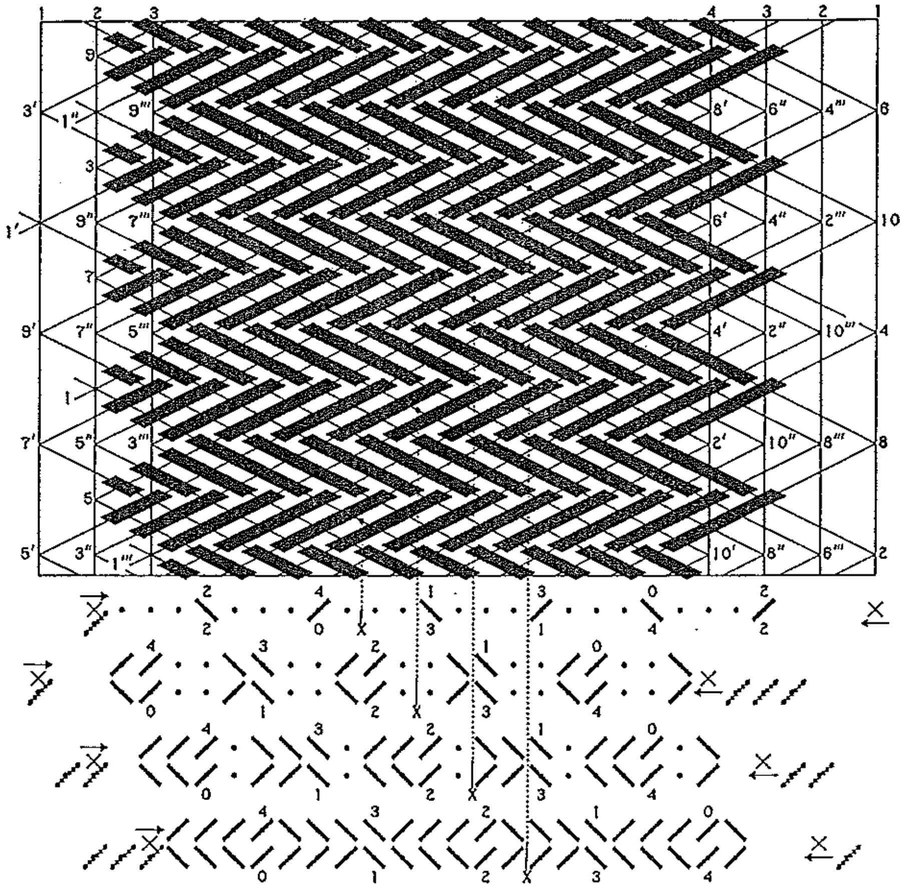


Fig. 871 — The knot over the oval bead.

Note that the half-cycles 10, 10′, 10″ and 10‴ have under-crossings to the left of the X-line in the algorithm diagrams. From these algorithm diagrams we read the following half-cycle braiding algorithms:

half-cycle 1 : $L_2 \longrightarrow R_1$: Free run.
half-cycle 2 : $i = 0$; $R_1 \longrightarrow L_2$: $(s)u$.
half-cycle 3 : $i = 0$; $L_2 \longrightarrow R_1$: u .
half-cycle 4 : $i \leq 1$; $R_1 \longrightarrow L_2$: $(s,1)2u$.
half-cycle 5 : $i \leq 1$; $L_2 \longrightarrow R_1$: $2u$.
half-cycle 6 : $i \leq 2$; $R_1 \longrightarrow L_2$: $(s,2)3u - (s)o$.
half-cycle 7 : $i \leq 2$; $L_2 \longrightarrow R_1$: $3u - o$.
half-cycle 8 : $i \leq 3$; $R_1 \longrightarrow L_2$: $2u - (s)o - u - o$.
half-cycle 9 : $i \leq 3$; $L_2 \longrightarrow R_1$: $2u - o - u - o$.
half-cycle 10 : $i \leq 4$; $R_1 \longrightarrow L$: $u - (s)o - u - o - (2,s)3u$.

---

half-cycle 1′ : $L_1 \longrightarrow R_4$: $o - u - o - u - o - u$.
half-cycle 2′ : $i = 0$; $R_4 \longrightarrow L_1$: $u - o - u - o - (1,s)2u - o$.
half-cycle 3′ : $i = 0$; $L_1 \longrightarrow R_4$: $o - u - o - u - 2o - u$.
half-cycle 4′ : $i \leq 1$; $R_4 \longrightarrow L_1$: $u - o - u - (1,s)2o - 2u - o$.
half-cycle 5′ : $i \leq 1$; $L_1 \longrightarrow R_4$: $o - u - o - 2u - 2o - u$.
half-cycle 6′ : $i \leq 2$; $R_4 \longrightarrow L_1$: $u - o - (1,s)2u - 2o - 2u - o$.
half-cycle 7′ : $i \leq 2$; $L_1 \longrightarrow R_4$: $o - u - 2o - 2u - 2o - u$.
half-cycle 8′ : $i \leq 3$; $R_4 \longrightarrow L_1$: $u - (1,s)2o - 2u - 2o - 2u - o$.

half-cycle $9'$: $i \leq 3$; $L_1 \longrightarrow R_4$: $o-2u-2o-2u-2o-u$.
half-cycle $10'$: $i \leq 4$; $R_4 \longrightarrow L$: $(1,s)2u-2o-(7,s)8u$.

half-cycle $1''$: $L_2 \longrightarrow R_3$: $2o-2u-2o-2u-2o-u$.
half-cycle $2''$: $i=0$; $R_3 \longrightarrow L_2$: $u-2o-2u-2o-(2,s)3u-2o$.
half-cycle $3''$: $i=0$; $L_2 \longrightarrow R_3$: $2o-2u-2o-2u-3o-u$.
half-cycle $4''$: $i \leq 1$; $R_3 \longrightarrow L_2$: $u-2o-2u-(2,s)3o-3u-2o$.
half-cycle $5''$: $i \leq 1$; $L_2 \longrightarrow R_3$: $2o-2u-2o-3u-3o-u$.
half-cycle $6''$: $i \leq 2$; $R_3 \longrightarrow L_2$: $u-2o-(2,s)3u-3o-3u-2o$.
half-cycle $7''$: $i \leq 2$; $L_2 \longrightarrow R_3$: $2o-2u-3o-3u-3o-u$.
half-cycle $8''$: $i \leq 3$; $R_3 \longrightarrow L_2$: $u-(2,s)3o-3u-3o-3u-2o$.
half-cycle $9''$: $i \leq 3$; $L_2 \longrightarrow R_3$: $2o-3u-3o-3u-3o-u$.
half-cycle $10''$: $i \leq 4$; $R_3 \longrightarrow L$: $(1,s)2u-3o-(11,s,1)13u$.

half-cycle $1'''$: $L_3 \longrightarrow R_2$: $3o-3u-3o-3u-3o-u$.
half-cycle $2'''$: $i=0$; $R_2 \longrightarrow L_3$: $u-3o-3u-3o-(3,s)4u-3o$.
half-cycle $3'''$: $i=0$; $L_3 \longrightarrow R_2$: $3o-3u-3o-3u-4o-u$.
half-cycle $4'''$: $i \leq 1$; $R_2 \longrightarrow L_3$: $u-3o-3u-(3,s)4o-4u-3o$.
half-cycle $5'''$: $i \leq 1$; $L_3 \longrightarrow R_2$: $3o-3u-3o-4u-4o-u$.
half-cycle $6'''$: $i \leq 2$; $R_2 \longrightarrow L_3$: $u-3o-(3,s)4u-4o-4u-3o$.
half-cycle $7'''$: $i \leq 2$; $L_3 \longrightarrow R_2$: $3o-3u-4o-4u-4o-u$.
half-cycle $8'''$: $i \leq 3$; $R_2 \longrightarrow L_3$: $u-(3,s)4o-4u-4o-4u-3o$.
half-cycle $9'''$: $i \leq 3$; $L_3 \longrightarrow R_2$: $3o-4u-4o-4u-4o-u$.
half-cycle $10'''$: $i \leq 4$; $R_2 \longrightarrow L$: $(1,s)2u-4o-(15,s,2)18u$.

Half-cycle 11 is Standing-end of half-cycle 1 from upper-left to lower-right, above half-cycle 10, with unders right of X-line:
half-cycle 11 : $L_2 \longrightarrow R$: $3u-4o-17u$.

Half-cycle $11'$ is Standing-end of half-cycle $1'$ from upper-left to lower-right, above half-cycle $10'$, with unders right of X-line:
half-cycle $11'$: $L_1 \longrightarrow R$: $o-4u-4o-15u$.

Half-cycle $11''$ is Standing-end of half-cycle $1''$ from upper-left to lower-right, above half-cycle $10''$, with unders right of X-line:
half-cycle $11''$: $L_2 \longrightarrow R$: $2o-4u-4o-13u$.

Half-cycle $11'''$ is Standing-end of half-cycle $1'''$ from upper-left to lower-right, above half-cycle $10'''$, with unders right of X-line:
half-cycle $11'''$: $L_3 \longrightarrow R$: $3o-4u-4o-11u$.

Instead of braiding each component in two stages as done above, we could braid each component in a single stage; for example as shown in Fig. 872.

Note that the half-cycles 1 , $1'$, $1''$ and $1'''$ have under crossings to the left of the X-line in the algorithm diagrams, and that the half-cycles 11 , $11'$, $11''$ and $11'''$ have under-crossings to the right of the X-line in the algorithm diagrams.

Immediately below the algorithm diagram for the $'$ half-cycles are indicated the intersections which the $'$ half-cycles from lower-right to upper-left make with the half-cycles 11 and 1. From the grid-diagram we see that the most right of such an intersection set occurs with half-cycle $8'$, and consequently is indicated by i_3 . Then four places to the left (since $A=4$) we get $i_{|3+\Delta^*|_{B^*}} = i_{|3+4|_5} = i_2$; and so on.

Immediately below the algorithm diagram for the $''$ half-cycles are indicated the intersections which the $''$ half-cycles from lower-right to upper-left make with the half-cycles 11′ and 1′, and with the half-cycles 11 and 1. From the grid-diagram we see that the most right of such an intersection set occurs with half-cycle 10″ and consequently is indicated by i_4 (it is associated with the ′ half-cycles 11′ and 1′). Then four places to the left (since $A = 4$) we get $i_{|4+\Delta^*|_{B^*}} = i_{|4+4|_5} = i_3$; and so on. From the grid-diagram we see that immediately to the left of the most right intersection set we get the intersection set associated with half-cycle 6″ and consequently is indicated by i_2 (it is associated with the half-cycles 11 and 1). Then four places to the left (since $A = 4$) we get $i_{|2+\Delta^*|_{B^*}} = i_{|2+4|_5} = i_1$; and so on.

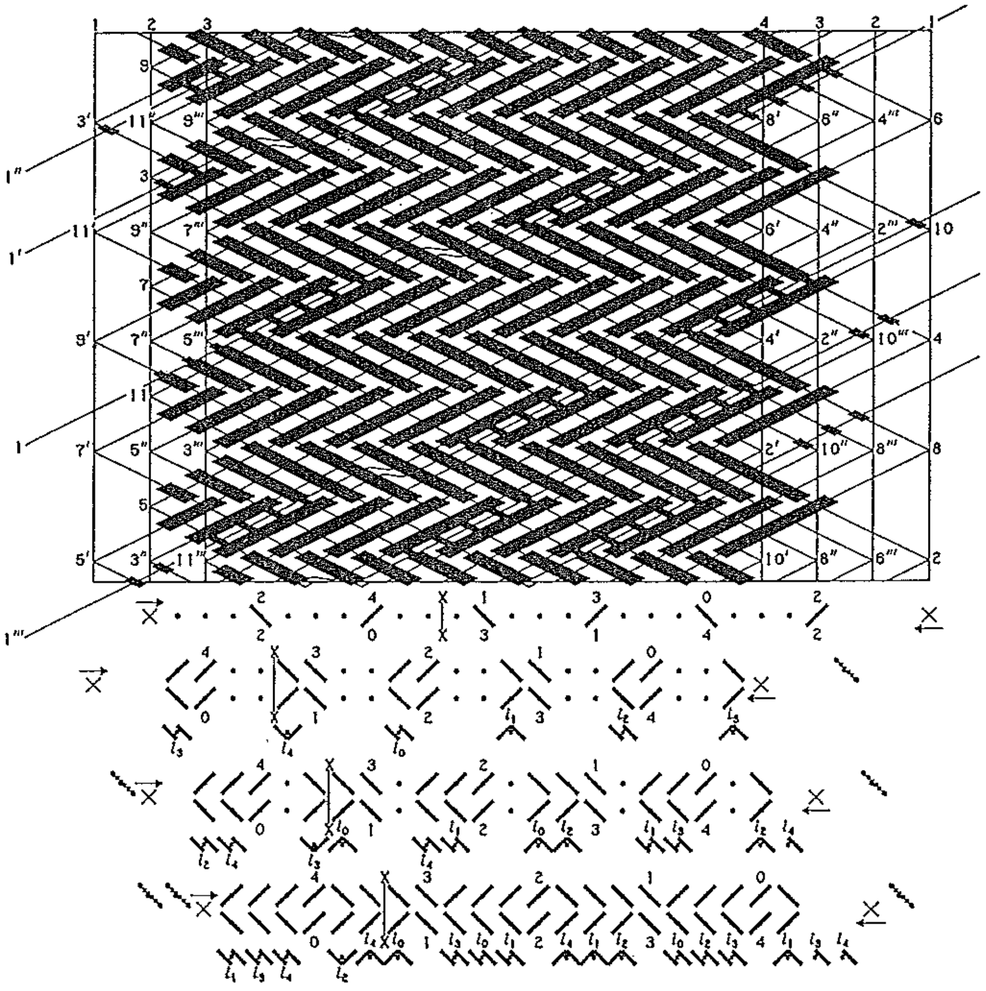


Fig. 872 — The knot over the oval bead.

Immediately below the algorithm diagram for the ‴ half-cycles are indicated the intersections which the ‴ half-cycles from lower-right to upper-left make with the half-cycles 11″ and 1″, with the half-cycles 11′ and 1′, and with the half-cycles 11 and 1. From the grid-diagram we see that the most right of such an intersection set occurs with half-cycle 10‴ and consequently is indicated by i_4 (it is associated with the ″ half-cycles 11″ and 1″). Then four places to the left (since $A = 4$) we get $i_{|4+\Delta^*|_{B^*}} = i_{|4+4|_5} = i_3$; and so on. From the grid-diagram we see that immediately to the left of the most right intersection set we get the intersection set associated with half-cycle 8‴ and consequently is indicated by i_3 (it is associated with the half-cycles 11′ and 1′). Then four places to the left (since $A = 4$) we get $i_{|3+\Delta^*|_{B^*}} = i_{|3+4|_5} = i_2$; and so on. From the grid-diagram we see that at the second place to the left of the most right intersection set we get the intersection set associated with half-cycle 4‴ and consequently is indicated by i_1 (it is associated with the half-cycles 11 and 1). Then four places to the left (since

$A = 4$) we get $i_{|1+\Delta^*|_{B^*}} = i_{|1+4|_5} = i_0$; and so on.

From these algorithm diagrams we read the following half-cycle braiding algorithms:

half-cycle 1 : $L \longrightarrow R_1$: Free run.
half-cycle 2 : $i = 0$; $R_1 \longrightarrow L_2$: o. (i=0: o left of X)
half-cycle 3 : $i = 0$; $L_2 \longrightarrow R_1$: u.
half-cycle 4 : $i \leq 1$; $R_1 \longrightarrow L_2$: $2u$.
half-cycle 5 : $i \leq 1$; $L_2 \longrightarrow R_1$: $2u$.
half-cycle 6 : $i \leq 2$; $R_1 \longrightarrow L_2$: $3u - o$.
half-cycle 7 : $i \leq 2$; $L_2 \longrightarrow R_1$: $3u - o$.
half-cycle 8 : $i \leq 3$; $R_1 \longrightarrow L_2$: $2u - o - u - o$.
half-cycle 9 : $i \leq 3$; $L_2 \longrightarrow R_1$: $2u - o - u - o$.
half-cycle 10 : $i \leq 4$; $R_1 \longrightarrow L$: $u - o - u - o - u - o$.
half-cycle 11 : $i \leq 4$; $L_2 \longrightarrow R$: $u - o - 4u$. (u right of X)

half-cycle $1'$: $L \longrightarrow R_4$: $2u - o - u - o - u$. (u left of X)
half-cycle $2'$: $i = 0$; $R_4 \longrightarrow L_1$: $u - o - u - 2o - u - 2o$. (i=0: o left of X)
half-cycle $3'$: $i = 0$; $L_1 \longrightarrow R_4$: $o - u - o - u - 2o - u$.
half-cycle $4'$: $i \leq 1$; $R_4 \longrightarrow L_1$: $u - 2o - u - 2o - 2u - o$.
half-cycle $5'$: $i \leq 1$; $L_1 \longrightarrow R_4$: $o - u - o - 2u - 2o - u$.
half-cycle $6'$: $i \leq 2$; $R_4 \longrightarrow L_1$: $u - 2o - 2u - 2o - 2u - o$.
half-cycle $7'$: $i \leq 2$; $L_1 \longrightarrow R_4$: $o - u - 2o - 2u - 2o - u$.
half-cycle $8'$: $i \leq 3$; $R_4 \longrightarrow L_1$: $o - u - 2o - 2u - 2o - 2u - 2o$.
half-cycle $9'$: $i \leq 3$; $L_1 \longrightarrow R_4$: $o - 2u - 2o - 2u - 2o - u$.
half-cycle $10'$: $i \leq 4$; $R_4 \longrightarrow L$: $2u - 2o - 2u - 2o - u - o - u - o$.
half-cycle $11'$: $i \leq 4$; $L_1 \longrightarrow R$: $2o - 10u$. (u right of X)

half-cycle $1''$: $L \longrightarrow R_3$: $5u - 2o - 2u - 2o - u$. (u left of X)
half-cycle $2''$: $i = 0$; $R_3 \longrightarrow L_2$: $u - 2o - u - o - u - 3o - 2u - 3o$. ($i$=0: o left of X)
half-cycle $3''$: $i = 0$; $L_2 \longrightarrow R_3$: $2o - 2u - 2o - 2u - 3o - u$.
half-cycle $4''$: $i \leq 1$; $R_3 \longrightarrow L_2$: $u - 3o - 2u - 4o - 3u - 2o$.
half-cycle $5''$: $i \leq 1$; $L_2 \longrightarrow R_3$: $2o - 2u - 2o - 3u - 3o - u$.
half-cycle $6''$: $i \leq 2$; $R_3 \longrightarrow L_2$: $o - u - 3o - 3u - 3o - 3u - 3o$.
half-cycle $7''$: $i \leq 2$; $L_2 \longrightarrow R_3$: $2o - 2u - 3o - 3u - 3o - u$.
half-cycle $8''$: $i \leq 3$; $R_3 \longrightarrow L_2$: $u - 4o - 3u - 3o - 2u - o - u - 2o$.
half-cycle $9''$: $i \leq 3$; $L_2 \longrightarrow R_3$: $2o - 3u - 3o - 3u - 3o - u$.
half-cycle $10''$: $i \leq 4$; $R_3 \longrightarrow L$: $o - 2u - 3o - 3u - 4o - 3u - 3o$.
half-cycle $11''$: $i \leq 4$; $L_2 \longrightarrow R$: $3o - 14u$. (u right of X)

half-cycle $1'''$: $L \longrightarrow R_2$: $8u - 3o - 3u - 3o - u$. (u left of X)
half-cycle $2'''$: $i = 0$; $R_2 \longrightarrow L_3$: $u - 4o - 3u - 5o - 3u - 4o$. ($i$=0: o left of X)
half-cycle $3'''$: $i = 0$; $L_3 \longrightarrow R_2$: $3o - 3u - 3o - 3u - 4o - u$.
half-cycle $4'''$: $i \leq 1$; $R_2 \longrightarrow L_3$: $o - u - 3o - u - o - 2u - 5o - 4u - 4o$.
half-cycle $5'''$: $i \leq 1$; $L_3 \longrightarrow R_2$: $3o - 3u - 3o - 4u - 4o - u$.
half-cycle $6'''$: $i \leq 2$; $R_2 \longrightarrow L_3$: $u - 5o - 4u - 4o - 3u - o - u - 3o$.
half-cycle $7'''$: $i \leq 2$; $L_3 \longrightarrow R_2$: $3o - 3u - 4o - 4u - 4o - u$.
half-cycle $8'''$: $i \leq 3$; $R_2 \longrightarrow L_3$: $o - u - 5o - 4u - 5o - 4u - 4o$.
half-cycle $9'''$: $i \leq 3$; $L_3 \longrightarrow R_2$: $3o - 4u - 4o - 4u - 4o - u$.
half-cycle $10'''$: $i \leq 4$; $R_2 \longrightarrow L$: $o - 2u - 4o - 2u - o - 2u - 4o - u - o - 3u - 4o$.
half-cycle $11'''$: $i \leq 4$; $L_3 \longrightarrow R$: $4o - 18u$. (u right of X)

Although we showed here this braiding method, it lacks practical usefulness since it is quite cumbersome as we must first obtain the associated much more involved algorithm diagrams. Furthermore, reading the half-cycle braiding algorithms from these algorithm diagrams is also more involved. Although a simple modification, where the final half-cycles 11, 11′, 11″ and 11‴ are braided last of all, makes it more user-friendly, the previously discussed braiding method is to be preferred. The algorithm diagrams associated with this modification are shown in Fig. 873, and the half-cycle braiding algorithms are read from them as follows:

half-cycle 1 : $L \longrightarrow R_1$: Free run.
half-cycle 2 : $i = 0$; $R_1 \longrightarrow L_2$: o . (i=0: o left of X)
half-cycle 3 : $i = 0$; $L_2 \longrightarrow R_1$: u .
half-cycle 4 : $i \leq 1$; $R_1 \longrightarrow L_2$: $2u$.
half-cycle 5 : $i \leq 1$; $L_2 \longrightarrow R_1$: $2u$.
half-cycle 6 : $i \leq 2$; $R_1 \longrightarrow L_2$: $3u - o$.
half-cycle 7 : $i \leq 2$; $L_2 \longrightarrow R_1$: $3u - o$.
half-cycle 8 : $i \leq 3$; $R_1 \longrightarrow L_2$: $2u - o - u - o$.
half-cycle 9 : $i \leq 3$; $L_2 \longrightarrow R_1$: $2u - o - u - o$.
half-cycle 10 : $i \leq 4$; $R_1 \longrightarrow L$: $u - o - u - o - u - 2o$.

half-cycle 1′ : $L \longrightarrow R_4$: $2u - o - u - o - u$. (u left of X)
half-cycle 2′ : $i = 0$; $R_4 \longrightarrow L_1$: $u - o - u - o - u - 2o$. (i=0: o left of X)
half-cycle 3′ : $i = 0$; $L_1 \longrightarrow R_4$: $o - u - o - u - 2o - u$.
half-cycle 4′ : $i \leq 1$; $R_4 \longrightarrow L_1$: $u - o - u - 2o - 2u - o$.
half-cycle 5′ : $i \leq 1$; $L_1 \longrightarrow R_4$: $o - u - o - 2u - 2o - u$.
half-cycle 6′ : $i \leq 2$; $R_4 \longrightarrow L_1$: $u - o - 2u - 2o - 2u - o$.
half-cycle 7′ : $i \leq 2$; $L_1 \longrightarrow R_4$: $o - u - 2o - 2u - 2o - u$.
half-cycle 8′ : $i \leq 3$; $R_4 \longrightarrow L_1$: $u - 2o - 2u - 2o - 2u - o$.
half-cycle 9′ : $i \leq 3$; $L_1 \longrightarrow R_4$: $o - 2u - 2o - 2u - 2o - u$.
half-cycle 10′ : $i \leq 4$; $R_4 \longrightarrow L$: $2u - 2o - 2u - 2o - 2u - 2o$.

half-cycle 1″ : $L \longrightarrow R_3$: $5u - 2o - 2u - 2o - u$. (u left of X)
half-cycle 2″ : $i = 0$; $R_3 \longrightarrow L_2$: $u - 2o - 2u - 2o - 2u - 3o$. (i=0: o left of X)
half-cycle 3″ : $i = 0$; $L_2 \longrightarrow R_3$: $2o - 2u - 2o - 2u - 3o - u$.
half-cycle 4″ : $i \leq 1$; $R_3 \longrightarrow L_2$: $u - 2o - 2u - 3o - 3u - 2o$.
half-cycle 5″ : $i \leq 1$; $L_2 \longrightarrow R_3$: $2o - 2u - 2o - 3u - 3o - u$.
half-cycle 6″ : $i \leq 2$; $R_3 \longrightarrow L_2$: $u - 2o - 3u - 3o - 3u - 2o$.
half-cycle 7″ : $i \leq 2$; $L_2 \longrightarrow R_3$: $2o - 2u - 3o - 3u - 3o - u$.
half-cycle 8″ : $i \leq 3$; $R_3 \longrightarrow L_2$: $u - 3o - 3u - 3o - u - o - u - 2o$.
half-cycle 9″ : $i \leq 3$; $L_2 \longrightarrow R_3$: $2o - 3u - 3o - 3u - 3o - u$.
half-cycle 10″ : $i \leq 4$; $R_3 \longrightarrow L$: $2u - 3o - 3u - 3o - 3u - 4o$.

half-cycle 1‴ : $L \longrightarrow R_2$: $8u - 3o - 3u - 3o - u$. (u left of X)
half-cycle 2‴ : $i = 0$; $R_2 \longrightarrow L_3$: $u - 3o - 3u - 3o - 3u - 4o$. (i=0: o left of X)
half-cycle 3‴ : $i = 0$; $L_3 \longrightarrow R_2$: $3o - 3u - 3o - 3u - 4o - u$.
half-cycle 4‴ : $i \leq 1$; $R_2 \longrightarrow L_3$: $u - 3o - 3u - 4o - 4u - 3o$.
half-cycle 5‴ : $i \leq 1$; $L_3 \longrightarrow R_2$: $3o - 3u - 3o - 4u - 4o - u$.
half-cycle 6‴ : $i \leq 2$; $R_2 \longrightarrow L_3$: $u - 3o - 4u - 4o - 2u - o - u - 3o$.
half-cycle 7‴ : $i \leq 2$; $L_3 \longrightarrow R_2$: $3o - 3u - 4o - 4u - 4o - u$.
half-cycle 8‴ : $i \leq 3$; $R_2 \longrightarrow L_3$: $u - 4o - 4u - 4o - 4u - 3o$.
half-cycle 9‴ : $i \leq 3$; $L_3 \longrightarrow R_2$: $3o - 4u - 4o - 4u - 4o - u$.
half-cycle 10‴ : $i \leq 4$; $R_2 \longrightarrow L$: $2u - 4o - 4u - 4o - 4u - 6o$.

Half-cycle 11 from lower-left to upper-right, below half-cycle 1, with unders right of X-line:

half-cycle 11 : $L_2 \longrightarrow R$: $4u - 4o - 4u - 16u$. (u right of X)

Half-cycle 11′ from lower-left to upper-right, below half-cycle 1′, with unders right of X-line:

half-cycle 11′ : $L_1 \longrightarrow R$: $2o - 22u$. (u right of X)

Half-cycle 11″ from lower-left to upper-right, below half-cycle 1″, with unders right of X-line:

half-cycle 11″ : $L_2 \longrightarrow R$: $3o - 20u$. (u right of X)

Half-cycle 11‴ from lower-left to upper-right, below half-cycle 1‴, with unders right of X-line:

half-cycle 11‴ : $L_3 \longrightarrow R$: $4o - 18u$. (u right of X)

Although this knot over the oval bead can be braided in a number of different ways as already mentioned earlier, the method outlined on pp. 1123 & 1124 is to be preferred. In order to set up the algorithm diagrams involved, it is of course important to draw first the associated grid-diagram.

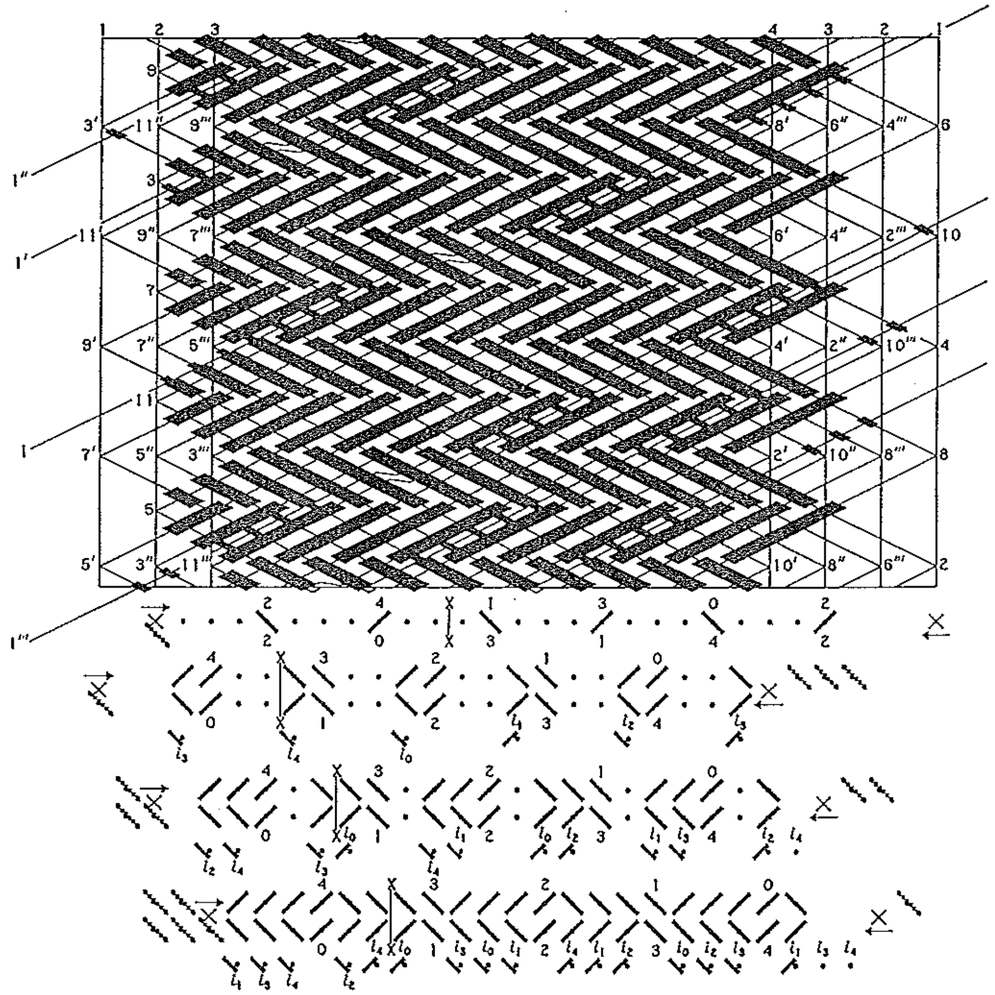


Fig. 873 — The knot over the oval bead.

A round bead with a diameter of 24 mm. is placed at the bottom of the stem in a similar way as the oval bead below the thimble. Over this round bead we braid the knot whose nominal grid-diagram is shown in Fig. 874 (left bight-edge towards thimble).

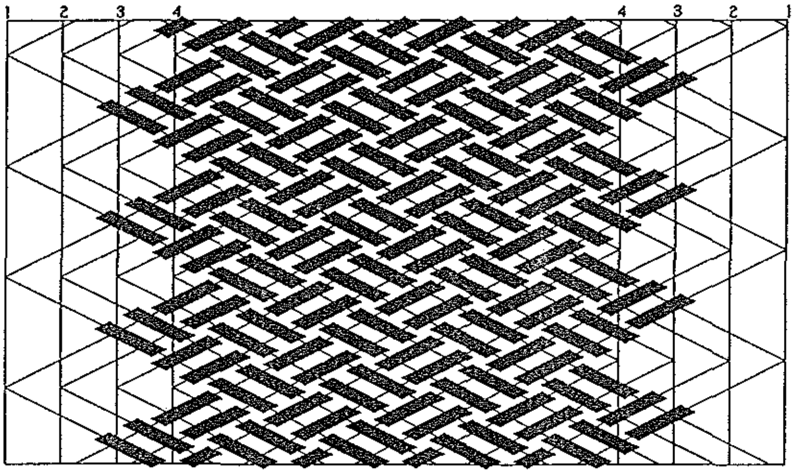


Fig. 874 — The nominal grid-diagram of the knot over the round bead.

The string-run of this nominal knot (a Regular Nested Cylindrical Braid with $A = 4$) is defined by $(222/16/222)\{1432/2341\}16$. Hence $x = 16$; $k = 2$ and thus $y = |x - 2(k+1)|_{2A} = |16 - 2(2+1)|_8 = 2$; $\Delta = |x - 2(k+1)|_A = |y|_A = |2|_4 = 2$.[†] The number of components (= the number of first-return string-runs) is equal to $\gamma = \text{g.c.d.}\,(\Delta, A) = \text{g.c.d.}\,(2,4) = 2$, and the number of bights in a first-return string-run is $\alpha = \frac{A}{\gamma} = \frac{4}{2} = 2$.[‡] $y' = y = 2$ and $\Delta' = \Delta = 2$.[††] Hence the number of components in the 1^{st} set is $\left|\frac{x+\Delta'-2}{2}\right|_\gamma = \left|\frac{16+2-2}{2}\right|_2 = |8|_2 = 0$, and the number of components in the 2^{nd} set is $\gamma - \left|\frac{x+\Delta'-2}{2}\right|_\gamma = 2 - \left|\frac{16+2-2}{2}\right|_2 = 2 - |8|_2 = 2 - 0 = 2$. The number of parts in each of these two components is $P_c = \frac{2A-\Delta'}{\gamma} + 2\left\lfloor\frac{x+\Delta'-2}{2\gamma}\right\rfloor = \frac{8-2}{2} + 2\left\lfloor\frac{16+2-2}{2\times 2}\right\rfloor = 3 + 8 = 11$. Since $\text{g.c.d.}\,(P_c, B^*) = \text{g.c.d.}\,(11,4) = 1$, each component requires only one essential string. Hence, if we want to braid this knot from one string, we have to transform it into an imitation form. Two such imitation forms are shown in respectively Fig. 875 and Fig. 876.

In both these two imitation forms, we braid first the component with the first-return string-run

$$\begin{array}{l} 1 \\ \quad\nwarrow \\ \qquad 4 \\ \quad\nearrow \\ 3 \\ \quad\nwarrow \\ \qquad 2 \\ \quad\nearrow \\ 1 \end{array}$$

In Fig. 875 we start with a lower-left to upper-right half-cycle between left bight-boundary 1 and right bight-boundary 2, while in Fig. 876 we start with a lower-left to upper-right half-cycle between left bight-boundary 3 and right bight-boundary 4. The string-run of the second component with its superimposed coding 'doubles' the string-run with its superimposed coding of the first component.

[†] See *The Braider*, Issue No. 24, pg. 557 and pg. 554.

[‡] See *The Braider*, Issue No. 25, pg. 570.

[††] See *The Braider*, Issue No. 25, pp. 570 - 571 and Appendix 2001, pg. *i*.

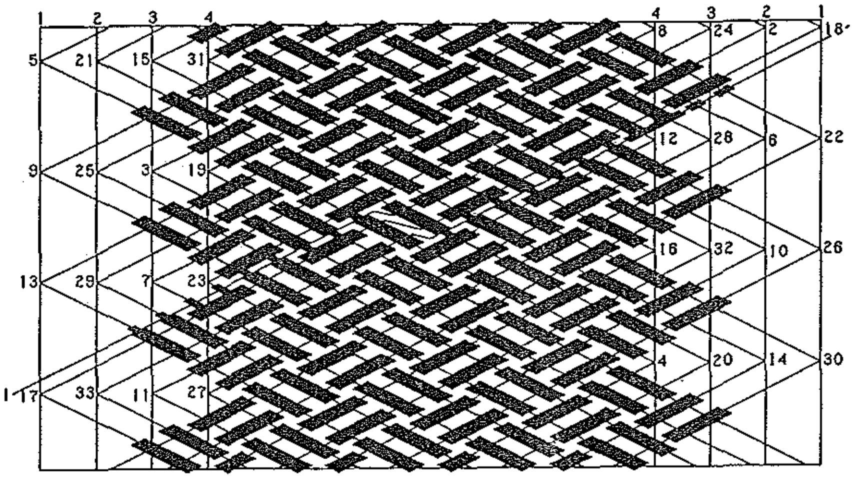


Fig. 875 — A one string imitation form of Fig. 874.

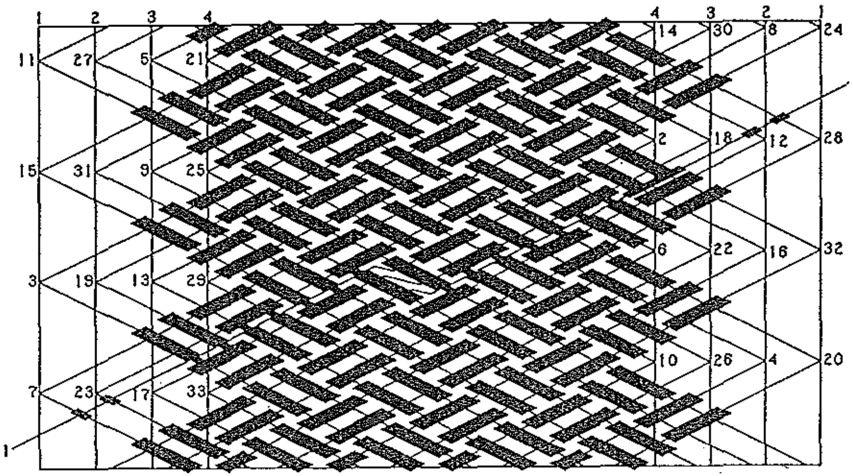


Fig. 876 — A one string imitation form of Fig. 874.

The first to be braided component in Fig. 875 is depicted in Fig. 877.

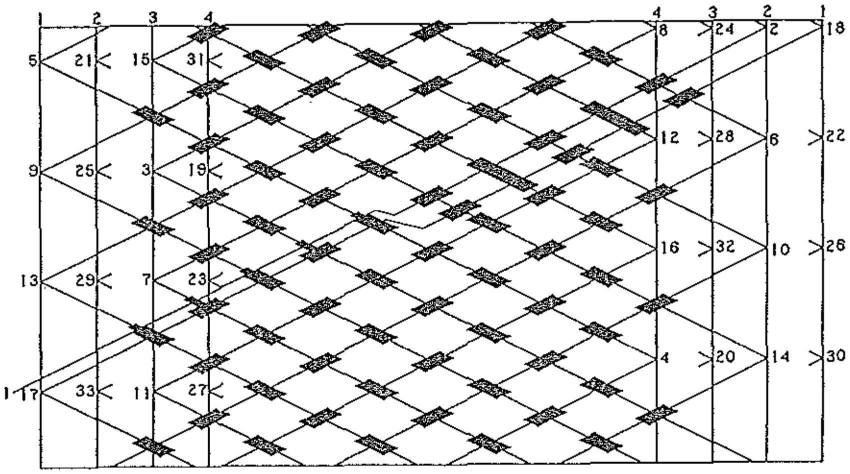
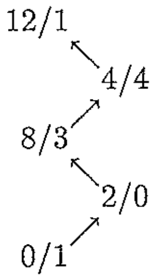


Fig. 877 — The first to be braided component in Fig. 875.

Let's first attach nest-index numbers to the bight-boundary numbers of its first-return string-run:[†]

[†] See *The Braider*, Issue No. 26, pg. 594.



$$
\begin{aligned}
I_L &= I_1 = 0\,.\\
I_R &= I_{1'} = 0\,.\\
I_L = I_2 &= |I_1 + 4A + x - (l_1 + l_2 + 2r_1)|_B =\\
&\quad |0 + 4\times 4 + 16 - (1 + 3 + 2\times 2)|_{16} = 8\,.\\
I_R = I_{2'} &= |I_{1'} + 4A + x - (r_1 + r_2 + 2l_2)|_B =\\
&\quad |0 + 4\times 4 + 16 - (2 + 4 + 2\times 3)|_{16} = 4\,.\\
I_L = I_3 &= |I_2 + 4A + x - (l_2 + l_3 + 2r_2)|_B =\\
&\quad |8 + 4\times 4 + 16 - (3 + 1 + 2\times 4)|_{16} = 12\,.
\end{aligned}
$$

Next we compile the half-cycle pattern in Fig. 878 associated with this component.[†]

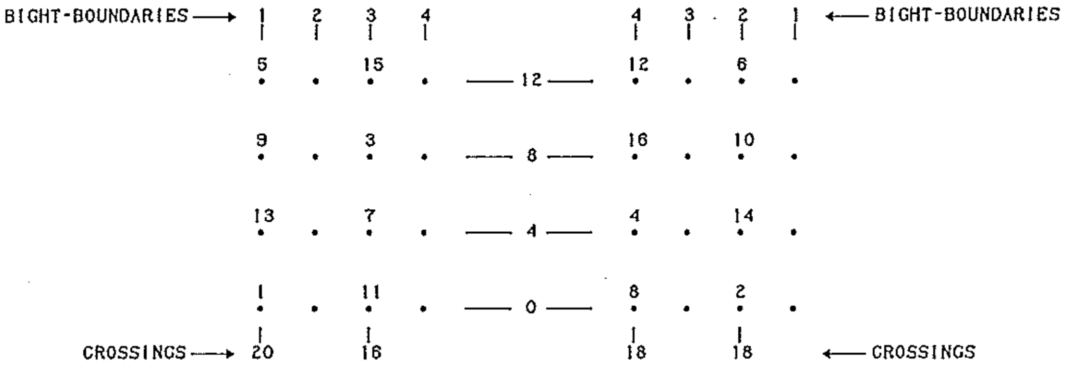
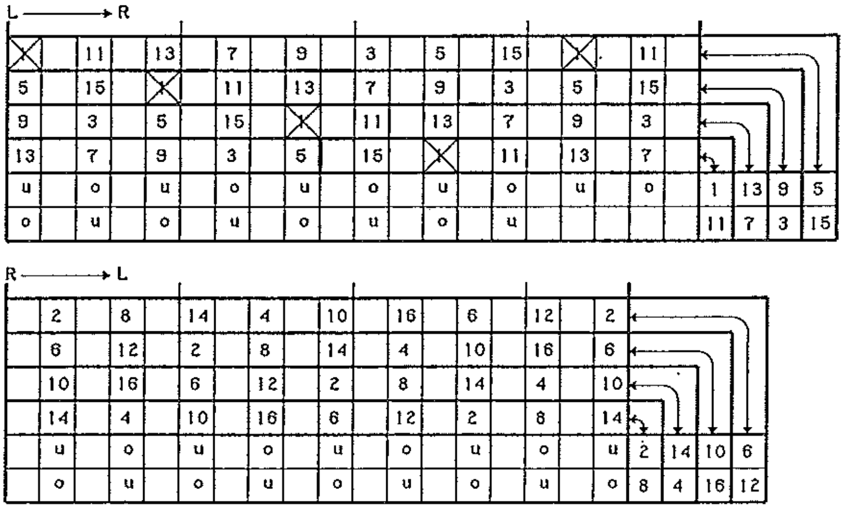


Fig. 878 — The half-cycle pattern associated with the foundation knot in Fig. 875.

From this half-cycle pattern we derive the half-cycle tables in Fig. 879 of the foundation knot.



☒		11		13		7		9		3		5		15		☒		11					
5		15		☒		11		13		7		9		3		5		15					
9		3		5		15		☒		11		13		7		9		3					
13		7		9		3		5		15		☒		11		13		7					
u		o		u		o		u		o		u		o		u		o		1	13	9	5
o		u		o		u		o		u		o		u						11	7	3	15

	2		8		14		4		10		16		6		12		2				
	6		12		2		8		14		4		10		16		6				
	10		16		6		12		2		8		14		4		10				
	14		4		10		16		6		12		2		8		14				
	u		o		u		o		u		o		u		o		u	2	14	10	6
	o		u		o		u		o		u		o		u		o	8	4	16	12

Fig. 879 — The half-cycle tables of the foundation knot in Fig. 875.

The first five crossings on the Standing End half-cycle 1 are **under**-crossings and consequently it are **over**-crossings for the even-numbered half-cycles from lower-right to upper-left. These even-numbered half-cycles are the half-cycles $13 - 1 = 12$; $7 - 1 = 6$; $9 - 1 = 8$; $3 - 1 = 2$; $5 - 1 = 4$ (they are indicated in the upper half-cycle table by their subsequent half-cycles 13 ; 7 ; 9 ; 3 ; 5 to the left of the short heavy vertical line-segment in the fourth row from the top; the over-crossings which these even-numbered half-cycles 12 ; 6 ; 8 ; 2 ; 4 make with the Standing End half-cycle 1 are in the last five crossing positions of the lower half-cycle table the crossing positions between these even-numbered half-cycles and half-cycle $1+1=2$).

[†] See *The Braider*, Issue No. 28, pp. 646 - 656, and Issue No. 31, pp. 710 - 713.

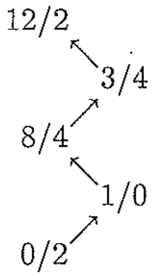
From these half-cycle tables we read the following half-cycle braiding algorithms for the foundation knot in Fig. 875:

half-cycle 1 : $L \longrightarrow R_2$: Free run.
half-cycle 2 : $R_2 \longrightarrow L_3$: o.
half-cycle 3 : $L_3 \longrightarrow R_4$: u.
half-cycle 4 : $R_4 \longrightarrow L_1$: $o-u$.
half-cycle 5 : $L_1 \longrightarrow R_2$: $o-u$.
half-cycle 6 : $R_2 \longrightarrow L_3$: $u-o-u-o$.
half-cycle 7 : $L_3 \longrightarrow R_4$: $u-o-u$.
half-cycle 8 : $R_4 \longrightarrow L_1$: $u-2o-u$.
half-cycle 9 : $L_1 \longrightarrow R_2$: $u-o-u-o-u$.
half-cycle 10 : $R_2 \longrightarrow L_3$: $2u-2o-2u$.
half-cycle 11 : $L_3 \longrightarrow R_4$: $u-o-u-o-u$.
half-cycle 12 : $R_4 \longrightarrow L_1$: $o-2u-2o-u-o$.
half-cycle 13 : $L_1 \longrightarrow R_2$: $u-o-u-o-u-o-u-o$.
half-cycle 14 : $R_2 \longrightarrow L_3$: $2u-o-u-o-u-o-u$.
half-cycle 15 : $L_3 \longrightarrow R_4$: $u-o-u-o-u-o-u$.
half-cycle 16 : $R_4 \longrightarrow L_1$: $o-u-o-u-o-u-o-u-o$.

For half-cycle 17 read half-cycle 1 without deleting cell 1:

half-cycle 17 : $L_1 \longrightarrow R_1$ $u-o-u-o-u-o-u-o-u-o$.

Half-cycle 17 can also be incorporated with the braiding of the second component. The first-return string-run of the second component with the nest-index numbers attached to its bight-boundary numbers is:



$$\begin{aligned}
I_L &= I_1 = 0.\\
I_R &= I_{1'} = 0.\\
I_L &= I_2 = |I_1 + 4A + x - (l_1 + l_2 + 2r_1)|_B =\\
&\quad |0 + 4\times 4 + 16 - (2 + 4 + 2\times 1)|_{16} = 8.\\
I_R &= I_{2'} = |I_{1'} + 4A + x - (r_1 + r_2 + 2l_2)|_B =\\
&\quad |0 + 4\times 4 + 16 - (1 + 3 + 2\times 4)|_{16} = 4.\\
I_L &= I_3 = |I_2 + 4A + x - (l_2 + l_3 + 2r_2)|_B =\\
&\quad |8 + 4\times 4 + 16 - (4 + 2 + 2\times 3)|_{16} = 12.
\end{aligned}$$

Next we compile the half-cycle pattern in Fig. 880 associated with this component.

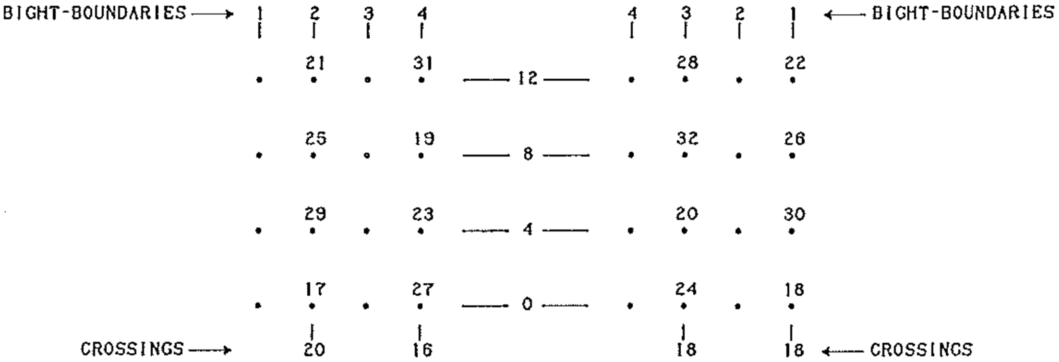
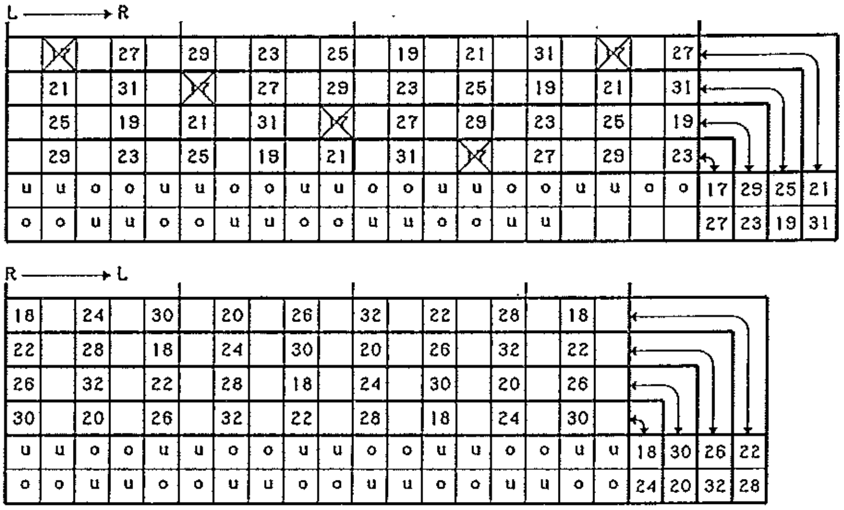


Fig. 880 — The half-cycle pattern associated with the second component in Fig. 875.

From this half-cycle pattern we derive the half-cycle tables in Fig. 881 of the second component.

The heavy vertical line-segment in the fourth row from the top indicates that the Standing End half-cycle 1 has **under**-crossings to the left of it and consequently it are **over**-crossings for the even-numbered half-cycles from lower-right to upper-left. These even-numbered half-cycles are the half-cycles $29 - 1 = 28$; $23 - 1 = 22$; $25 - 1 = 24$; $19 - 1 = 18$; $21 - 1 = 20$ (the over-crossings which these even-numbered half-cycles 28 ; 22 ; 24 ; 18 ; 20 make with the Standing End half-cycle 1 are in the last ten crossing positions of the lower half-cycle table the crossing positions which immediately follow the crossing positions between these even-numbered half-cycles and half-cycle $17 + 1 = 18$).



	~~17~~		27		29		23		25		19		21		31		~~17~~		27				
	21		31		~~17~~		27		29		23		25		19		21		31				
	25		19		21		31		~~17~~		27		29		23		25		19				
	29		23		25		19		21		31		~~17~~		27		29		23				
u	u	o	o	u	u	o	o	u	u	o	o	u	u	o	o	u	u	o	o	17	29	25	21
o	o	u	u	o	o	u	u	o	o	u	u	o	o	u	u					27	23	19	31

18		24		30		20		26		32		22		28		18					
22		28		18		24		30		20		26		32		22					
26		32		22		28		18		24		30		20		26					
30		20		26		32		22		28		18		24		30					
u	u	o	o	u	u	o	o	u	u	o	o	u	u	o	o	u	u	18	30	26	22
o	o	u	u	o	o	u	u	o	o	u	u	o	o	u	u	o	o	24	20	32	28

Fig. 881 — The half-cycle tables of the second component in Fig. 875.

From these half-cycle tables we read the following half-cycle braiding algorithms for the second component knot in Fig. 875:

half-cycle 17 : $L_2 \longrightarrow R_1$: $u - o - u - o - u - o - u - o - u - o$.
half-cycle 18 : $R_1 \longrightarrow L_4$: $u - o - u - o - u - o - u - 2o - u$.
half-cycle 19 : $L_4 \longrightarrow R_3$: $o - u - o - u - o - u - o - 2u$.
half-cycle 20 : $R_3 \longrightarrow L_2$: $o - u - o - u - 2o - u - o - 2u - o$.
half-cycle 21 : $L_2 \longrightarrow R_1$: $u - o - u - o - u - 2o - 2u - o - u - o$.
half-cycle 22 : $R_1 \longrightarrow L_4$: $2u - o - u - 2o - u - o - 2u - o - u - o$.
half-cycle 23 : $L_4 \longrightarrow R_3$: $o - 2u - 2o - u - o - u - o - 2u$.
half-cycle 24 : $R_3 \longrightarrow L_2$: $o - 2u - o - u - 2o - u - 2o - 2u - o$.
half-cycle 25 : $L_2 \longrightarrow R_1$: $2u - o - u - o - u - 2o - 2u - 2o - 2u - o$.
half-cycle 26 : $R_1 \longrightarrow L_4$: $2u - o - 2u - 2o - u - 2o - 2u - o - 2u$.
half-cycle 27 : $L_4 \longrightarrow R_3$: $o - 2u - 2o - 2u - 2o - u - o - 2u$.
half-cycle 28 : $R_3 \longrightarrow L_2$: $2o - 2u - o - 2u - 2o - u - 2o - 2u - 2o$.
half-cycle 29 : $L_2 \longrightarrow R_1$: $2u - 2o - 2u - o - u - 2o - 2u - 2o - 2u - 2o$.
half-cycle 30 : $R_1 \longrightarrow L_4$: $2u - o - 2u - 2o - 2u - 2o - 2u - 2o - 2u$.
half-cycle 31 : $L_4 \longrightarrow R_3$: $o - 2u - 2o - 2u - 2o - 2u - 2o - 2u$.
half-cycle 32 : $R_3 \longrightarrow L_2$: $2o - 2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o$.

Read half-cycle 33 from the grid-diagram in Fig. 875:

half-cycle 33 : $L_2 \longrightarrow R$ $2u - 2o - 2u - 2o - 8u - 4o$.

An easier, and hence better, way to braid the knot in Fig. 875 is to take half-cycle 2 as the Standing End half-cycle, and hence lay half-cycle 1 down last of all, that is after half-cycle 32. Its associated grid-diagram is shown in Fig. 882.

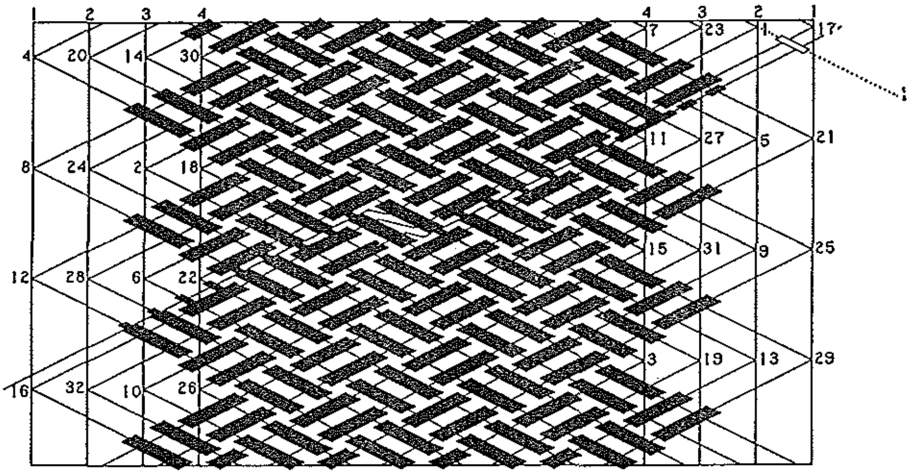


Fig. 882 — An easier way to braid the knot in Fig. 875.

In a similar way we can braid the knot in Fig. 874 by starting at the left bight-edge as shown in Fig. 883.

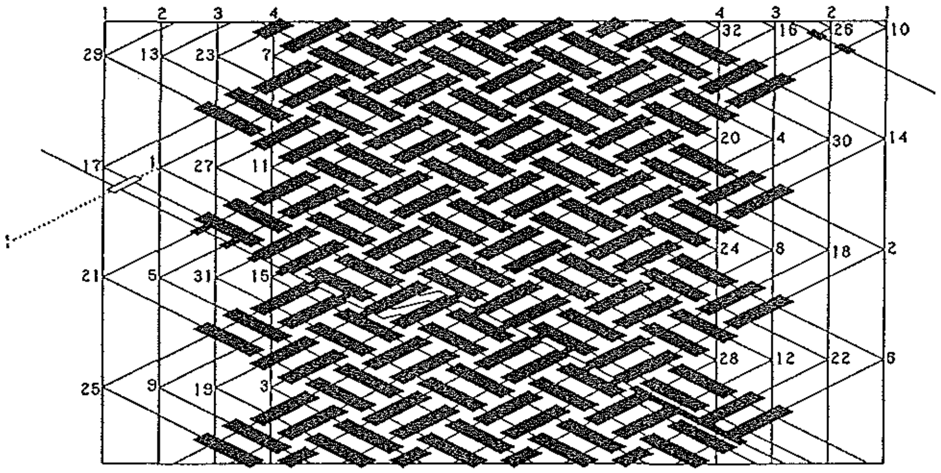
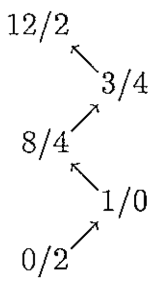


Fig. 883 — A preferred way to braid the knot in Fig. 874.

Fig. 884 shows the first-return string-run of the foundation knot of the knot depicted in Fig. 883 (the foundation knot is shown in Fig. 885).



$$
\begin{aligned}
I_L = I_1 &= 0\,.\\
I_R = I_{1'} &= 0\,.\\
I_L = I_2 &= |I_1 + 4A + x - (l_1 + l_2 + 2r_1)|_B =\\
&\ |0 + 4 \times 4 + 16 - (2 + 4 + 2 \times 1)|_{16} = 8\,.\\
I_R = I_{2'} &= |I_{1'} + 4A + x - (r_1 + r_2 + 2l_2)|_B =\\
&\ |0 + 4 \times 4 + 16 - (1 + 3 + 2 \times 4)|_{16} = 4\,.\\
I_L = I_3 &= |I_2 + 4A + x - (l_2 + l_3 + 2r_2)|_B =\\
&\ |8 + 4 \times 4 + 16 - (4 + 2 + 2 \times 3)|_{16} = 12\,.
\end{aligned}
$$

Fig. 884 — The first-return string-run of the foundation knot in Fig. 885.

Next we compile in Fig. 886 the half-cycle pattern associated with this foundation knot, and from this half-cycle pattern we compile in Fig. 887 the half-cycle tables of the foundation knot. Then from these half-cycle tables we read the half-cycle braiding algorithms for the foundation knot.

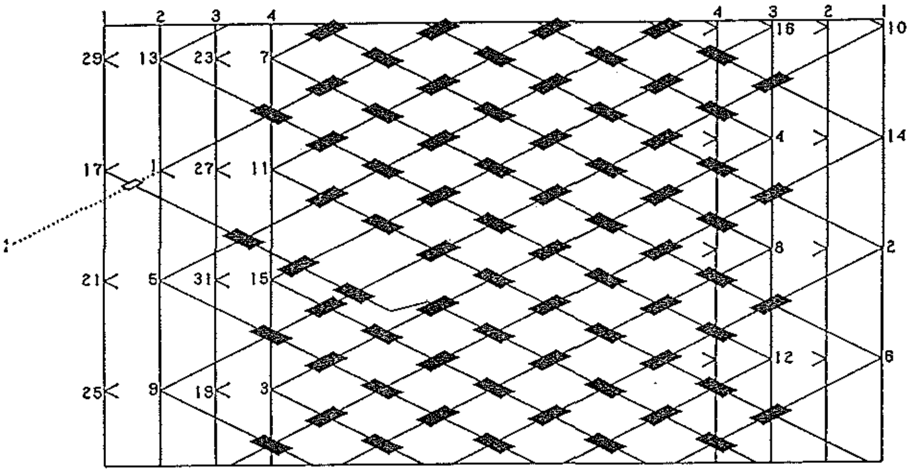


Fig. 885 — The foundation knot of the knot in Fig. 883.

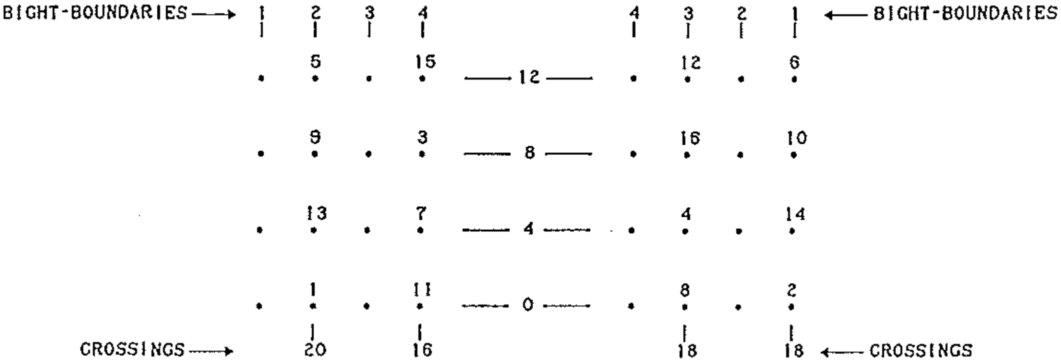
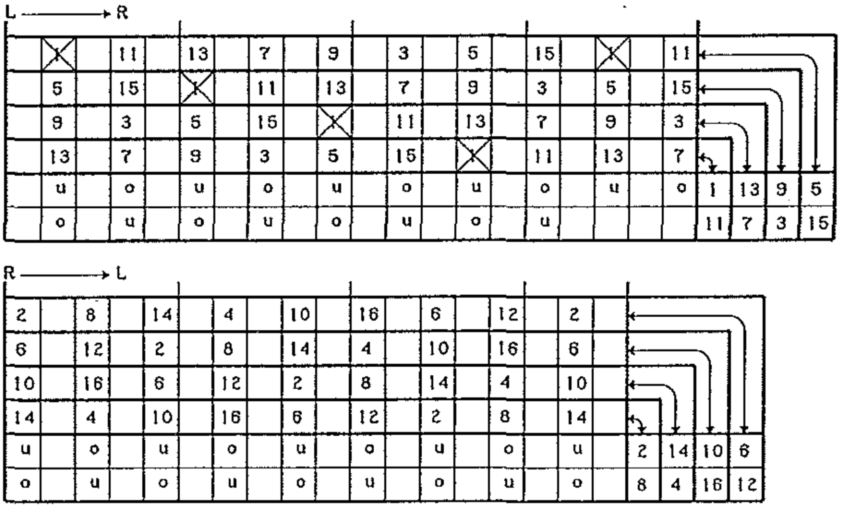


Fig. 886 — The half-cycle pattern associated with the foundation knot in Fig. 885.



L → R

	~~1~~		11		13		7		9		3		5		15		~~1~~		11				
	5		15		~~1~~		11		13		7		9		3		5		15				
	9		3		5		15		~~1~~		11		13		7		9		3				
	13		7		9		3		5		15		~~1~~		11		13		7				
	u		o		u		o		u		o		u		o		u		o	1	13	9	5
	o		u		o		u		o		u		o		u					11	7	3	15

R → L

2		8		14		4		10		16		6		12		2					
6		12		2		8		14		4		10		16		6					
10		16		6		12		2		8		14		4		10					
14		4		10		16		6		12		2		8		14					
u		o		u		o		u		o		u		o		u		2	14	10	6
o		u		o		u		o		u		o		u		o		8	4	16	12

Fig. 887 — The half-cycle tables of the foundation knot in Fig. 885.

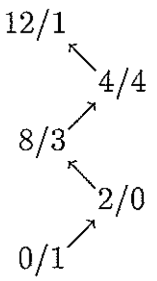
The half-cycle braiding algorithms for the foundation knot are as follows:

half-cycle 1 : $L \longrightarrow R_1$: Free run.
half-cycle 2 : $R_1 \longrightarrow L_4$: u.
half-cycle 3 : $L_4 \longrightarrow R_3$: u.
half-cycle 4 : $R_3 \longrightarrow L_2$: $o-u$.
half-cycle 5 : $L_2 \longrightarrow R_1$: $o-u$.

half-cycle 6 : $R_1 \longrightarrow L_4$: $u - o - 2u$.
half-cycle 7 : $L_4 \longrightarrow R_3$: $u - o - u$.
half-cycle 8 : $R_3 \longrightarrow L_2$: $u - 2o - u$.
half-cycle 9 : $L_2 \longrightarrow R_1$: $u - o - u - o - u$.
half-cycle 10 : $R_1 \longrightarrow L_4$: $2u - 2o - 2u$.
half-cycle 11 : $L_4 \longrightarrow R_3$: $u - o - u - o - u$.
half-cycle 12 : $R_3 \longrightarrow L_2$: $o - 2u - 2o - u - o$.
half-cycle 13 : $L_2 \longrightarrow R_1$: $u - o - u - o - u - o - u - o$.
half-cycle 14 : $R_1 \longrightarrow L_4$: $2u - o - u - o - u - o - u$.
half-cycle 15 : $L_4 \longrightarrow R_3$: $u - o - u - o - u - o - u$.
half-cycle 16 : $R_3 \longrightarrow L_1$: $o - u - o - u - o - u - o - u - o - u$.

Note that the last crossing on half-cycle 16 is an under; this crossing will disappear when the Standing End half-cycle gets finished by laying it down from upper-left to lower-right.

The first-return string-run of the second component with the nest-index numbers attached to its bight-boundary numbers is:



$$
\begin{aligned}
I_L &= I_1 = 0\,.\\
I_R &= I_{1'} = 0\,.\\
I_L &= I_2 = |I_1 + 4A + x - (l_1 + l_2 + 2r_1)|_B = \\
&\qquad |0 + 4\times 4 + 16 - (1 + 3 + 2\times 2)|_{16} = 8\,.\\
I_R &= I_{2'} = |I_{1'} + 4A + x - (r_1 + r_2 + 2l_2)|_B = \\
&\qquad |0 + 4\times 4 + 16 - (2 + 4 + 2\times 3)|_{16} = 4\,.\\
I_L &= I_3 = |I_2 + 4A + x - (l_2 + l_3 + 2r_2)|_B = \\
&\qquad |8 + 4\times 4 + 16 - (3 + 1 + 2\times 4)|_{16} = 12\,.
\end{aligned}
$$

Next we compile the half-cycle pattern in Fig. 888 associated with this component.

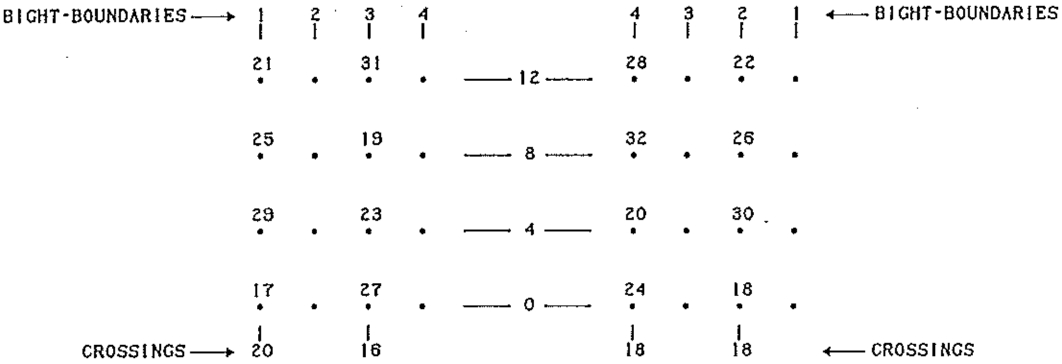


Fig. 888 — The half-cycle pattern associated with the second component in Fig. 883.

From this half-cycle pattern of the second component we derive its half-cycle tables in Fig. 889.

Next, from these half-cycle tables we read the half-cycle braiding algorithms for the second component knot in Fig. 883:

half-cycle 17 : $L_1 \longrightarrow R_2$: $u - o - u - o - u - o - u - o - u - o$.
half-cycle 18 : $R_2 \longrightarrow L_3$: $u - o - u - o - u - o - 2u - o - u$.
half-cycle 19 : $L_3 \longrightarrow R_4$: $o - u - o - u - o - u - o - 2u$.
half-cycle 20 : $R_4 \longrightarrow L_1$: $o - u - o - u - 2o - u - o - 2u - o$.
half-cycle 21 : $L_1 \longrightarrow R_2$: $u - o - u - o - u - 2o - 2u - o - u - o$.
half-cycle 22 : $R_2 \longrightarrow L_3$: $2u - o - u - 2o - u - o - 2u - o - 2u$.

half-cycle 23 : $L_3 \longrightarrow R_4$: $o - 2u - 2o - u - o - u - o - 2u$.
half-cycle 24 : $R_4 \longrightarrow L_1$: $o - 2u - o - u - 2o - u - 2o - 2u - o$.
half-cycle 25 : $L_1 \longrightarrow R_2$: $2u - o - u - o - u - 2o - 2u - 2o - 2u - o$.
half-cycle 26 : $R_2 \longrightarrow L_3$: $2u - o - 2u - 2o - u - 2o - 2u - o - 2u$.
half-cycle 27 : $L_3 \longrightarrow R_4$: $o - 2u - 2o - 2u - 2o - u - o - 2u$.
half-cycle 28 : $R_4 \longrightarrow L_1$: $2o - 2u - o - 2u - 2o - u - 2o - 2u - 2o$.
half-cycle 29 : $L_1 \longrightarrow R_2$: $2u - 2o - 2u - o - u - 2o - 2u - 2o - 2u - 2o$.
half-cycle 30 : $R_2 \longrightarrow L_3$: $2u - o - 2u - 2o - 2u - 2o - 2u - 2o - 2u$.
half-cycle 31 : $L_3 \longrightarrow R_4$: $o - 2u - 2o - 2u - 2o - 2u - 2o - 2u$.
half-cycle 32 : $R_4 \longrightarrow L_1$: $2o - 2u - 2o - 2u - 2o - 9u$.

Finally the Standing End half-cycle from upper-left L_2 to lower-right R: $2o - 2u - 2o - 8u - 6o$.

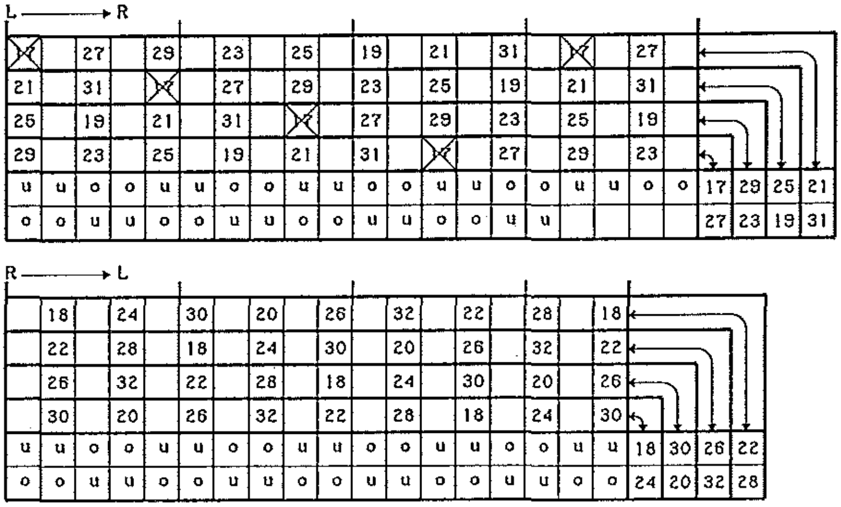


Fig. 889 — The half-cycle tables of the second component in Fig. 883.

There are several other ways to braid the knot in Fig. 874. One of those would be to braid it from the four strings of the even or the odd numbered Crown Knots in the construction of the stem-braid, as for example shown in Fig. 890. When using the parallel braiding method, the half-cycle braiding algorithms would then be as follows:

half-cycle 1 ; 1′ ; 1″ ; 1‴ : $R \longrightarrow L_4$: Free run.
half-cycle 2 ; 2′ ; 2″ ; 2‴ : $L_4 \longrightarrow R_3$: $u - 3o$.
half-cycle 3 ; 3′ ; 3″ ; 3‴ : $R_3 \longrightarrow L_2$: $4u$.
half-cycle 4 ; 4′ ; 4″ ; 4‴ : $L_2 \longrightarrow R_1$: $u - o - u - o - u - o - u - o - u - o$.
half-cycle 5 ; 5′ ; 5″ ; 5‴ : $R_1 \longrightarrow L_3$: $u - o - u - o - u - o - u - o - u$.
half-cycle 6 ; 6′ ; 6″ ; 6‴ : $L_3 \longrightarrow R_4$: $o - 2u - o - u - 3o - u - 3o - u - o$.
half-cycle 7 ; 7′ ; 7″ ; 7‴ : $R_4 \longrightarrow L_1$: $o - 2u - o - 2u - o - 2u - o - 2u - o$.
half-cycle 8 ; 8′ ; 8″ ; 8‴ : $L_1 \longrightarrow R_2$: $2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o$.
half-cycle 9 ; 9′ ; 9″ ; 9‴ : $R_2 \longrightarrow L$: $2u - 2o - 2u - 2o - 2u - 2o - 8u$.

A Regular Nested Knot with $A = 4$ and a $2o - 2u$ chequered coding pattern must have one of the following string-run specifications:

(i). $(222/4m + 2/222)\{1432/2341\}B$; $k = 2$.
(ii). $(222/4m + 2/222)\{1432/4123\}B$; $k = 4$.
(iii). $(222/4m + 4/222)\{1432/2341\}B$; $k = 2$.
(iv). $(222/4m + 4/222)\{1432/4123\}B$; $k = 4$.

$y = |x - 2k - 2|_{2A}$ and $\Delta = |y|_A$.[†]

$$\begin{array}{lll}
\text{For } k = 2 : y = |x-6|_8 & x = 4m+2 \rightarrow y = |4m-4|_8 & \text{for } m = \text{even} : y = 4\,;\ \Delta = 0\,. \\
 & P = 4m+8 & \text{for } m = \text{odd}\ \ : y = 0\,;\ \Delta = 0\,. \\
 & x = 4m+4 \rightarrow y = |4m-2|_8 & \text{for } m = \text{even} : y = 6\,;\ \Delta = 2\,. \\
 & P = 4m+10 & \text{for } m = \text{odd}\ \ : y = 2\,;\ \Delta = 2\,. \\
\text{For } k = 4 : y = |x-2|_8 & x = 4m+2 \rightarrow y = |4m|_8 & \text{for } m = \text{even} : y = 0\,;\ \Delta = 0\,. \\
 & P = 4m+8 & \text{for } m = \text{odd}\ \ : y = 4\,;\ \Delta = 0\,. \\
 & x = 4m+4 \rightarrow y = |4m+2|_8 & \text{for } m = \text{even} : y = 2\,;\ \Delta = 2\,. \\
 & P = 4m+10 & \text{for } m = \text{odd}\ \ : y = 6\,;\ \Delta = 2\,.
\end{array}$$

Thus $m = 3$ for the nominal knot in Fig. 874, and consequently $y = 2\,;\ \Delta = 2$.

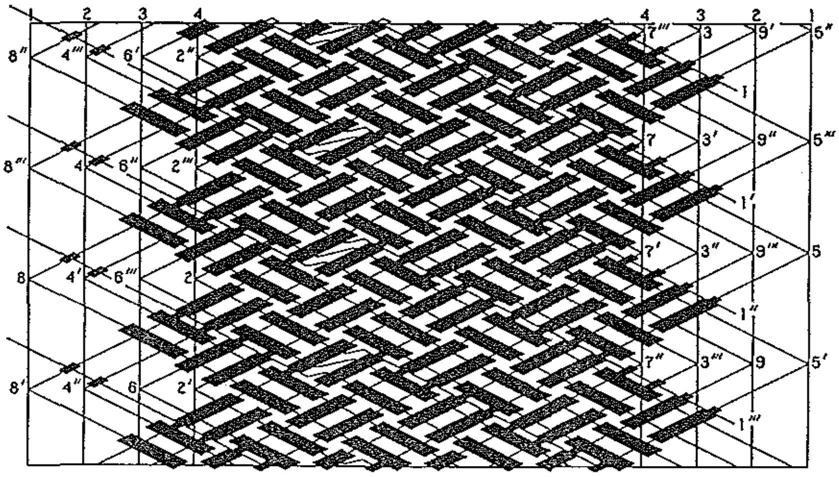


Fig. 890 — Using the four strings of a Crown Knot.

As shown in Fig. 891, we can also use a different string-colour for each of the two components in Fig. 874, and say we braid this knot as shown in Fig. 892.

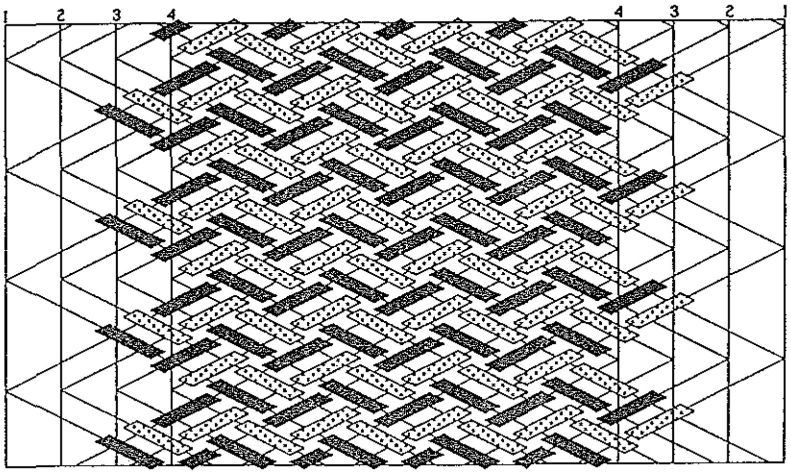


Fig. 891 — A different colour for the two components in Fig. 874.

Let the foundation knot (the first component) start with half-cycle 1, and the second component with half-cycle 1'. Let's braid last of all the Standing End of half-cycle 1 from upper-left bight-boundary 3 to lower-right and the Standing End of half-cycle 1' from upper-left bight-boundary 2 to lower-right.

[†] See *The Braider*, Issue No. 24, pg. 557.

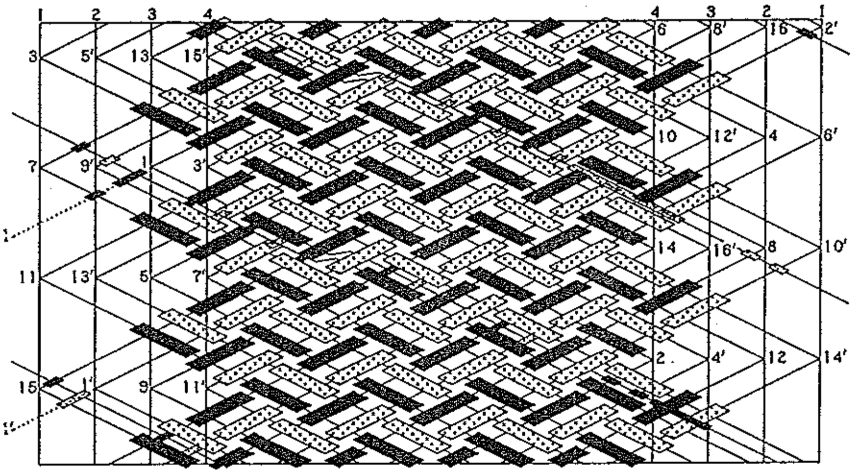
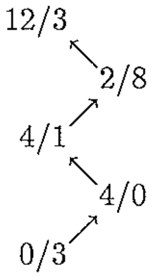


Fig. 892 — Braiding the knot in Fig. 891.

First we compile the first-return string-run of the foundation knot (the first component):



$$\begin{aligned}
I_L = I_1 &= 0\,.\\
I_R = I_{1'} &= 0\,.\\
I_L = I_2 &= |I_1 + 4A + x - (l_1 + l_2 + 2r_1)|_B =\\
&\quad |0 + 4 \times 4 + 16 - (3 + 1 + 2 \times 4)|_{16} = 4\,.\\
I_R = I_{2'} &= |I_{1'} + 4A + x - (r_1 + r_2 + 2l_2)|_B =\\
&\quad |0 + 4 \times 4 + 16 - (4 + 2 + 2 \times 1)|_{16} = 8\,.\\
I_L = I_3 &= |I_2 + 4A + x - (l_2 + l_3 + 2r_2)|_B =\\
&\quad |4 + 4 \times 4 + 16 - (1 + 3 + 2 \times 2)|_{16} = 12\,.
\end{aligned}$$

Next we compile in Fig. 893 the half-cycle pattern associated with this foundation knot.

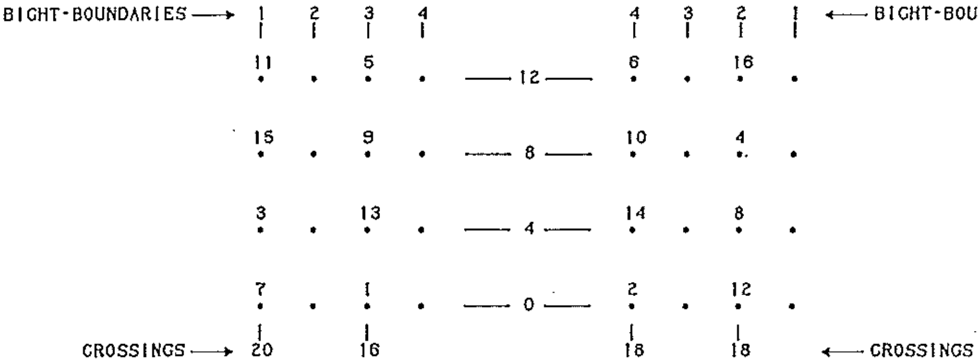
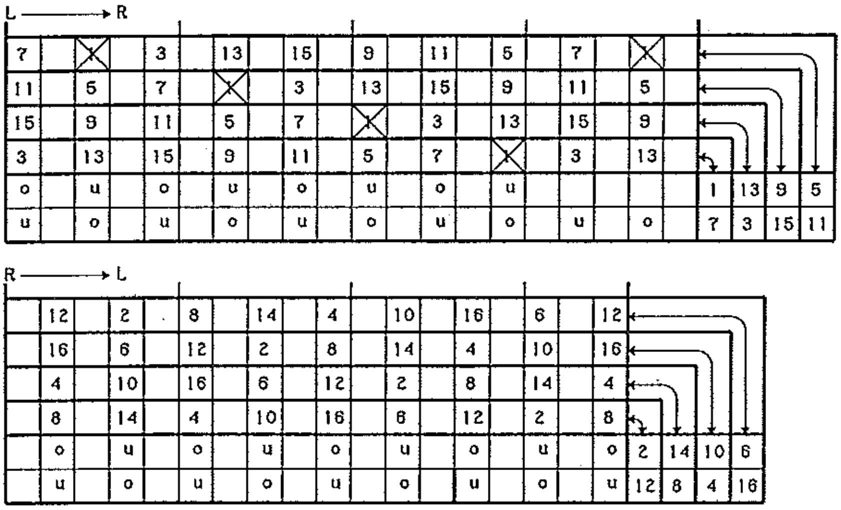


Fig. 893 — The half-cycle pattern of the foundation knot.

From this half-cycle pattern we compile in Fig. 894 the half-cycle tables of the foundation knot. The crossings to the right of the short heavy vertical line-segment in the lower half-cycle table of the foundation knot (Fig. 894) are unders for half-cycle 16. Half-cycle 6 of the foundation knot has an additional final under-crossing (under-crossing with the Standing End of half-cycle 1). Half-cycle 16 of the foundation knot has two additional final under-crossings (with respectively the Standing End of half-cycle 1 and half-cycle 7). Then from these half-cycle tables we read the half-cycle braiding algorithms for the foundation knot.



L → R

7		$\xcancel{1}$		3		13		15		9		11		5		7		$\xcancel{1}$					
11		5		7		$\xcancel{1}$		3		13		15		9		11		5					
15		9		11		5		7		$\xcancel{1}$		3		13		15		9					
3		13		15		9		11		5		7		$\xcancel{1}$		3		13					
o		u		o		u		o		u		o		u						1	13	9	5
u		o		u		o		u		o		u		o		u		o		7	3	15	11

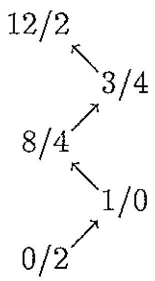
R → L

	12		2		8		14		4		10		16		6		12				
	16		6		12		2		8		14		4		10		16				
	4		10		16		6		12		2		8		14		4				
	8		14		4		10		16		6		12		2		8				
	o		u		o		u		o		u		o		u		o	2	14	10	6
	u		o		u		o		u		o		u		o		u	12	8	4	16

Fig. 894 — The half-cycle tables of the foundation knot.

half-cycle 1 : $L \longrightarrow R_4$: Free run.
half-cycle 2 : $R_4 \longrightarrow L_1$: u .
half-cycle 3 : $L_1 \longrightarrow R_2$: u .
half-cycle 4 : $R_2 \longrightarrow L_3$: $o - u$.
half-cycle 5 : $L_3 \longrightarrow R_4$: $o - u$.
half-cycle 6 : $R_4 \longrightarrow L_1$: $u - o - 2u$.
half-cycle 7 : $L_1 \longrightarrow R_2$: $u - o - 2u$.
half-cycle 8 : $R_2 \longrightarrow L_3$: $u - 2o - 2u$.
half-cycle 9 : $L_3 \longrightarrow R_4$: $u - 2o - u$.
half-cycle 10 : $R_4 \longrightarrow L_1$: $2u - 2o - u$.
half-cycle 11 : $L_1 \longrightarrow R_2$: $2u - o - u - o - u$.
half-cycle 12 : $R_2 \longrightarrow L_3$: $2u - 2o - u - o - u$.
half-cycle 13 : $L_3 \longrightarrow R_4$: $u - o - u - 2o - u$.
half-cycle 14 : $R_4 \longrightarrow L_1$: $o - 2u - o - u - o - u - o$.
half-cycle 15 : $L_1 \longrightarrow R_2$: $u - o - 2u - o - u - o - u - o$.
half-cycle 16 : $R_2 \longrightarrow L$: $u - o - u - o - u - o - 5u$.

Fig. 895 shows the first-return string-run of the second component.



$$
\begin{aligned}
I_L = I_1 &= 0 . \\
I_R = I_{1'} &= 0 . \\
I_L = I_2 &= |I_1 + 4A + x - (l_1 + l_2 + 2r_1)|_B = \\
&\quad |0 + 4 \times 4 + 16 - (2 + 4 + 2 \times 1)|_{16} = 8 . \\
I_R = I_{2'} &= |I_{1'} + 4A + x - (r_1 + r_2 + 2l_2)|_B = \\
&\quad |0 + 4 \times 4 + 16 - (1 + 3 + 2 \times 4)|_{16} = 4 . \\
I_L = I_3 &= |I_2 + 4A + x - (l_2 + l_3 + 2r_2)|_B = \\
&\quad |8 + 4 \times 4 + 16 - (4 + 2 + 2 \times 3)|_{16} = 12 .
\end{aligned}
$$

Fig. 895 — The first-return string-run of the second component.

Next we compile in Fig. 896 the half-cycle pattern associated with this second component, and from this half-cycle pattern we compile in Fig. 897 the half-cycle tables of the second component.

Half-cycle $1'$ of the second component has an additional initial over-crossing (over-crossing with half-cycle 14). Half-cycles $7'$ and $13'$ of the second component have over-crossings with half-cycle 16 (this are the crossings of half-cycles $7'$ and $13'$ with half-cycle 1 in the upper half-cycle table of the second component in Fig. 897). Half-cycle $8'$ of the second component has an additional final under-crossing (under-crossing with the Standing End of half-cycle 1). Half-cycle $9'$ of the second component has an additional initial over-crossing (over-crossing with half-cycle 16). Half-cycle $16'$ of the second component has under-crossings to the right of the short heavy vertical line-segment in the lower half-cycle table of Fig. 897. Half-cycle $16'$ of the second component has two additional final under-crossings (with Standing End of half-cycle $1'$ and half-cycle 15).

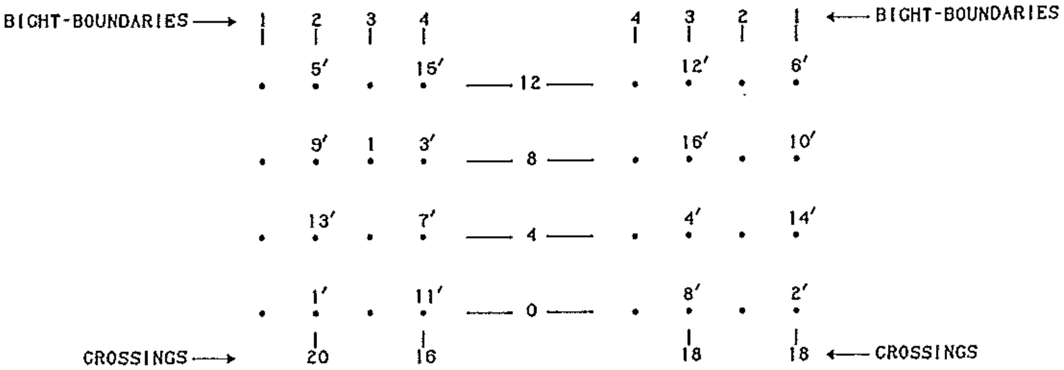
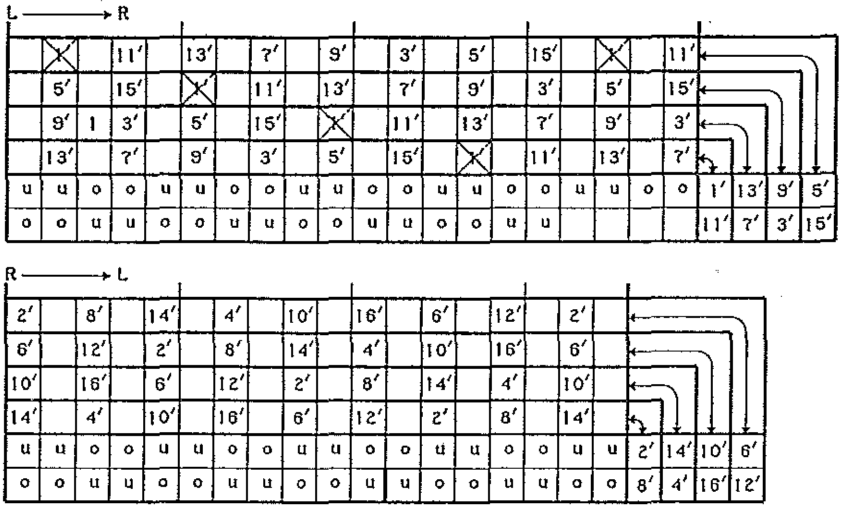


Fig. 896 — The half-cycle pattern of the second component.



	☒		11′		13′		7′		9′		3′		5′		15′		☒		11′				
	5′		15′		☒		11′		13′		7′		9′		3′		5′		15′				
	9′	1	3′		5′		15′		☒		11′		13′		7′		9′		3′				
	13′		7′		9′		3′		5′		15′		☒		11′		13′		7′				
u	u	o	o	u	u	o	o	u	u	o	o	u	u	o	o	u	u	o	o	1′	13′	9′	5′
o	o	u	u	o	o	u	u	o	o	u	u	o	o	u	u					11′	7′	3′	15′

2′		8′		14′		4′		10′		16′		6′		12′		2′					
6′		12′		2′		8′		14′		4′		10′		16′		6′					
10′		16′		6′		12′		2′		8′		14′		4′		10′					
14′		4′		10′		16′		6′		12′		2′		8′		14′					
u	u	o	o	u	u	o	o	u	u	o	o	u	u	o	o	u	u	2′	14′	10′	6′
o	o	u	u	o	o	u	u	o	o	u	u	o	o	u	u	o	o	8′	4′	16′	12′

Fig. 897 — The half-cycle tables of the second component.

Then from these half-cycle tables we read the half-cycle braiding algorithms for the second component:

half-cycle $1'$: $L \longrightarrow R_1$: $o-u-o-u-o-u-o-u-o-u-o$.
half-cycle $2'$: $R_1 \longrightarrow L_4$: $u-o-u-o-u-o-2u-o-u$.
half-cycle $3'$: $L_4 \longrightarrow R_3$: $o-u-o-u-o-u-o-2u$.
half-cycle $4'$: $R_3 \longrightarrow L_2$: $o-u-o-u-2o-u-o-2u-o$.
half-cycle $5'$: $L_2 \longrightarrow R_1$: $u-o-u-o-u-2o-2u-o-u-o$.
half-cycle $6'$: $R_1 \longrightarrow L_4$: $2u-o-u-2o-u-o-2u-o-2u$.
half-cycle $7'$: $L_4 \longrightarrow R_3$: $2o-u-2o-u-o-u-o-2u$.
half-cycle $8'$: $R_3 \longrightarrow L_2$: $o-2u-o-u-2o-u-2o-2u-o-u$.
half-cycle $9'$: $L_2 \longrightarrow R_1$: $o-2u-o-u-o-u-2o-2u-2o-2u-o$.
half-cycle $10'$: $R_1 \longrightarrow L_4$: $2u-o-2u-2o-u-2o-2u-o-2u$.
half-cycle $11'$: $L_4 \longrightarrow R_3$: $o-2u-2o-2u-2o-u-o-2u$.

half-cycle 12′ : $R_3 \longrightarrow L_2$: $2o - 2u - o - 2u - 2o - u - 2o - 2u - 2o$.
half-cycle 13′ : $L_2 \longrightarrow R_1$: $2u - 2o - 2u - o - u - 2o - 2u - 2o - 2u - 2o$.
half-cycle 14′ : $R_1 \longrightarrow L_4$: $2u - o - 2u - 2o - 2u - 2o - 2u - 2o - 2u$.
half-cycle 15′ : $L_4 \longrightarrow R_3$: $o - 2u - 2o - 2u - 2o - 2u - 2o - 2u$.
half-cycle 16′ : $R_3 \longrightarrow L$: $2o - 2u - 2o - 2u - 2o - 10u$.

Finally:

Standing End of half-cycle 1 from upper-left L_3 to lower-right R:
$2u - 2o - 10u - 5o$.

Standing End of half-cycle 1′ from upper-left L_2 to lower-right R:
$2o - 2u - 2o - 8u - 6o$.

The left bight-edge of the knots in Figs. 875, 876, 882, 883, 890, 891, and 892 surrounds the braid of the stem. Although the encirclement is quite acceptable, a better encirclement is obtained with a knot whose nominal grid-diagram is depicted in Fig. 898 (left bight-edge towards thimble).

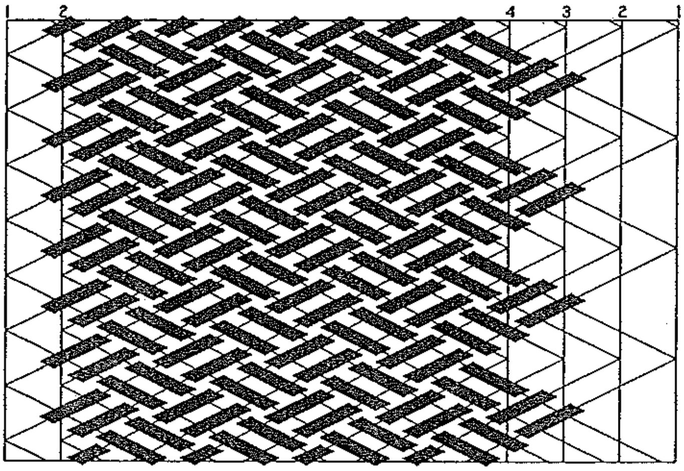


Fig. 898 — The nominal grid-diagram of an alternative knot over the round bead.

The string-run of this Asymmetric Regular Nested Cylindrical Braid is defined by (2/16/222){12/2341}16.[†]

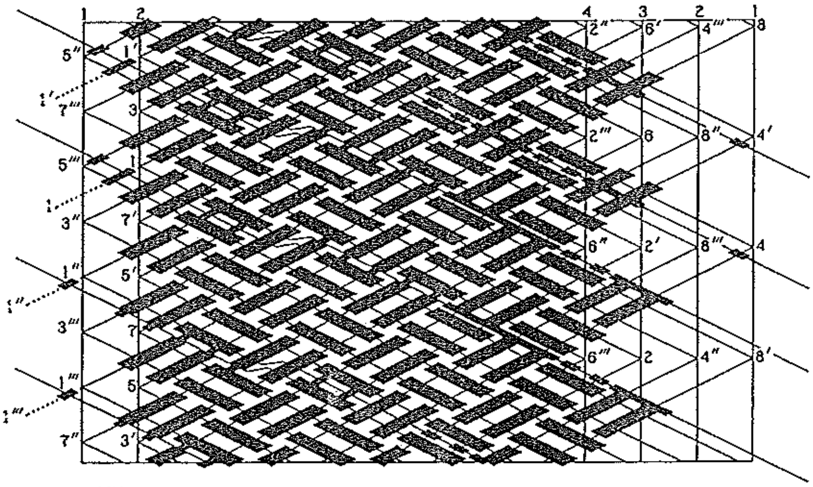


Fig. 899 — Braiding the knot in Fig. 898.

[†] An alternative definition for its string-run is (2/16/222){12/4123}16.

Fig. 899 depicts one of the ways in which the knot in Fig. 898 can be braided. Note that the knot in Fig. 898 and hence its construction in Fig. 899 consists of four inter-braided over-under coded Regular Knots with $p/b = 5/4$, and hence for these Regular Knots $\Delta^* = 3$.

In order to simplify the setting up of the algorithm diagrams associated with Fig. 899, we modify Fig. 899 into Fig. 900.

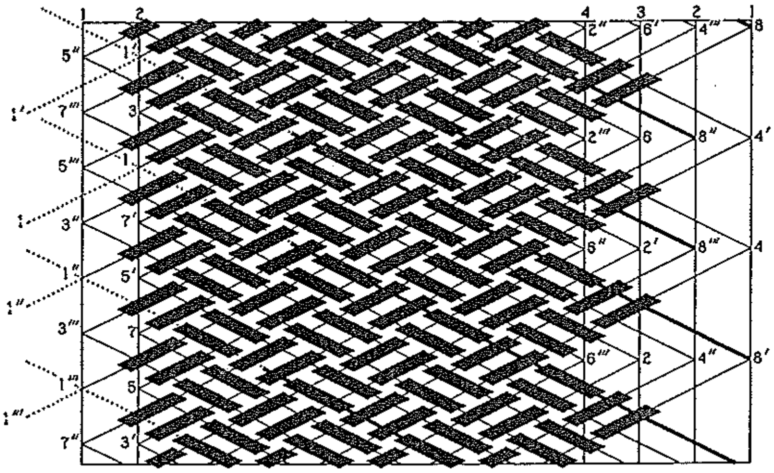


Fig. 900 — The modified form of Fig. 899.

We braid the half-cycles in the sequence $1 - 8$; $1' - 8'$; $1'' - 8''$; $1''' - 8'''$. After that we braid from upper-left to lower-right the Standing Ends of half-cycles 1; $1'$; $1''$; $1'''$. The half-cycles $4''$; $4'''$; 8; $8'$; $8''$ end each with 1 extra **under**-crossing. Half-cycle $8'''$ ends with 2 extra **under**-crossings, and half-cycles $5''$; $5'''$ start each with 1 extra **over**-crossing. The half-cycles 8; $8'$; $8''$; $8'''$ have **under**-crossings to the **left** of the vertical line in the algorithm diagrams. The Standing Ends of half-cycles 1 and $1'$ from upper-left to lower-right have the sequence $2u - 2o - 6u - 8o$, and the Standing Ends of half-cycles $1''$ and and $1'''$ from upper-left to lower-right have the sequence $2u - 2o - 6u - 9o$. In the algorithm diagrams we indicate with W ; W′ ; W″ the crossings of half-cycles $1'$; $1''$; $1'''$ with respectively the half-cycles 8 ; $8'$; $8''$; any of such a crossing to the **left** of the vertical line in the algorithm diagrams is an **over**-crossing for the first half-cycle under consideration. We indicate with W_i ; W'_i ; W''_i the crossings of the other odd-numbered $'$; $''$; $'''$ half-cycles with respectively the half-cycles 8; $8'$; $8''$; any of such a crossing to the **left** of the vertical line in the algorithm diagrams is an **over**-crossing for the i-value associated with the half-cycle under consideration.

For the first component the half-cycle braiding algorithms are:

half-cycle 1 : : $L \longrightarrow R_3$: Free run.
half-cycle 2 : $i = 0$: $R_3 \longrightarrow L_2$: u.
half-cycle 3 : $i = 0$: $L_2 \longrightarrow R_1$: u.
half-cycle 4 : $i \leq 1$: $R_1 \longrightarrow L_2$: $o - u$.
half-cycle 5 : $i \leq 1$: $L_2 \longrightarrow R_3$: $o - u$.
half-cycle 6 : $i \leq 2$: $R_3 \longrightarrow L_2$: $u - o - u$.
half-cycle 7 : $i \leq 2$: $L_2 \longrightarrow R_1$: $u - o - u$.
half-cycle 8 : $i \leq 3$: $R_1 \longrightarrow L$: $o - u - o - 2u$.

For the second component the half-cycle braiding algorithms are:

half-cycle $1'$: : $L \longrightarrow R_3$: $u - o - u - o$.
half-cycle $2'$: $i = 0$: $R_3 \longrightarrow L_2$: $u - o - u - o - u$.

half-cycle $3'$: $i = 0$: $L_2 \longrightarrow R_1$: $o - u - o - 2u - o$.
half-cycle $4'$: $i \leq 1$: $R_1 \longrightarrow L_2$: $u - o - u - o - u - o - u$.
half-cycle $5'$: $i \leq 1$: $L_2 \longrightarrow R_3$: $3o - u - o - u$.
half-cycle $6'$: $i \leq 2$: $R_3 \longrightarrow L_2$: $u - o - u - o - u - o - u$.
half-cycle $7'$: $i \leq 2$: $L_2 \longrightarrow R_1$: $o - 2u - o - u - o - u - o$.
half-cycle $8'$: $i \leq 3$: $R_1 \longrightarrow L$: $u - o - u - o - u - o - 4u$.

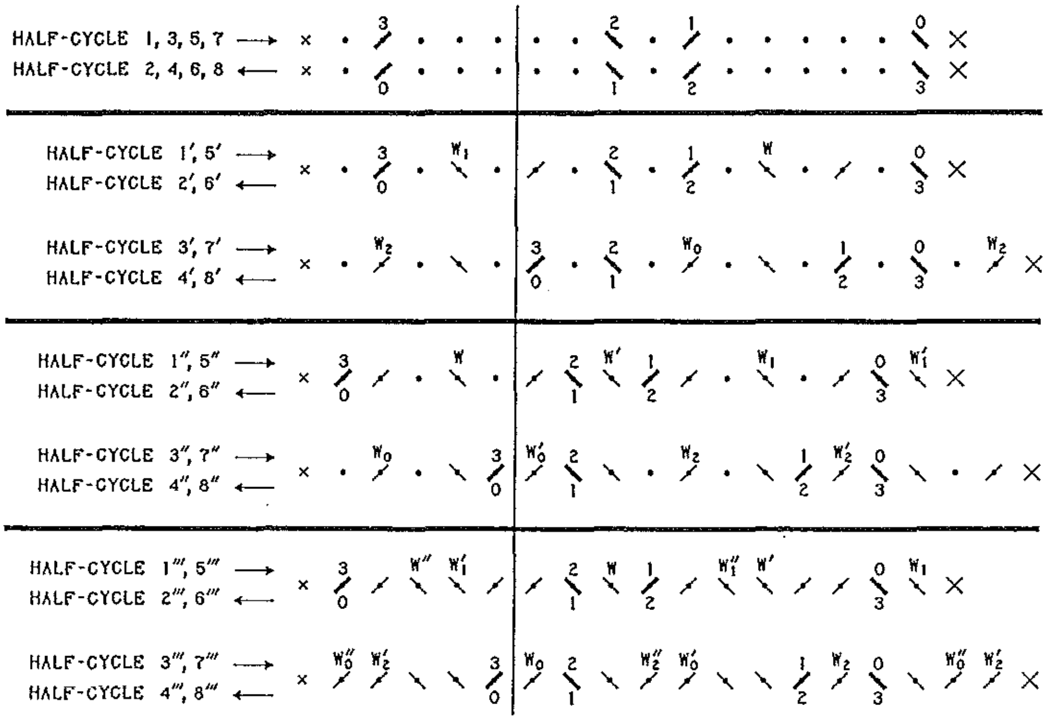


Fig. 901 — The algorithm diagrams associated with Fig. 900.

For the third component the half-cycle braiding algorithms are:

half-cycle $1''$: : $L \longrightarrow R_4$: $3o - u - o - u - o - u$.
half-cycle $2''$: $i = 0$: $R_4 \longrightarrow L_1$: $o - u - o - u - o - u - o - 2u$.
half-cycle $3''$: $i = 0$: $L_1 \longrightarrow R_2$: $o - u - o - u - o - u - o - 2u - o$.
half-cycle $4''$: $i \leq 1$: $R_2 \longrightarrow L_1$: $u - o - u - o - u - 2o - 2u - o - 2u$.
half-cycle $5''$: $i \leq 1$: $L_1 \longrightarrow R_4$: $2o - u - o - u - 2o - u - o - 2u$.
half-cycle $6''$: $i \leq 2$: $R_4 \longrightarrow L_1$: $o - u - o - 2u - 2o - u - o - 2u$.
half-cycle $7''$: $i \leq 2$: $L_1 \longrightarrow R_2$: $o - u - o - 2u - o - u - 2o - 2u - o$.
half-cycle $8''$: $i \leq 3$: $R_2 \longrightarrow L$: $u - 2o - 2u - o - u - 2o - 5u$.

For the fourth component the half-cycle braiding algorithms are:

half-cycle $1'''$: : $L \longrightarrow R_4$: $2o - u - 2o - u - o - 2u - 2o - u$.
half-cycle $2'''$: $i = 0$: $R_4 \longrightarrow L_1$: $o - 2u - 2o - u - o - 2u - 2o - 2u$.
half-cycle $3'''$: $i = 0$: $L_1 \longrightarrow R_2$: $2o - 2u - o - u - 2o - 2u - o - 2u - 2o$.
half-cycle $4'''$: $i \leq 1$: $R_2 \longrightarrow L_1$: $2u - o - u - 2o - 2u - 2o - 2u - 2o - 3u$.
half-cycle $5'''$: $i \leq 1$: $L_1 \longrightarrow R_4$: $2o - u - 3o - u - 2o - 2u - 2o - 2u$.
half-cycle $6'''$: $i \leq 2$: $R_4 \longrightarrow L_1$: $o - 2u - 2o - 2u - 2o - 2u - 2o - 2u$.
half-cycle $7'''$: $i \leq 2$: $L_1 \longrightarrow R_2$: $2o - 2u - o - 2u - 2o - 2u - 2o - 2u - 2o$.
half-cycle $8'''$: $i \leq 3$: $R_2 \longrightarrow L$: $2u - 2o - 2u - 2o - 2u - 2o - 7u$.

Then we braid the Standing Ends as indicated earlier, and finally the free ends of the strings can be cut off.

THE BRAIDER

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for
the braiding artisan

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Braid Design

Many 'new' braids can also be designed by combining elements of UT-OT braids with flat braids, cylindrical braids and torus braids. In Fig. 901 a cylindrical UT-OT element with a right helix is interbraided with a Regular Knot.

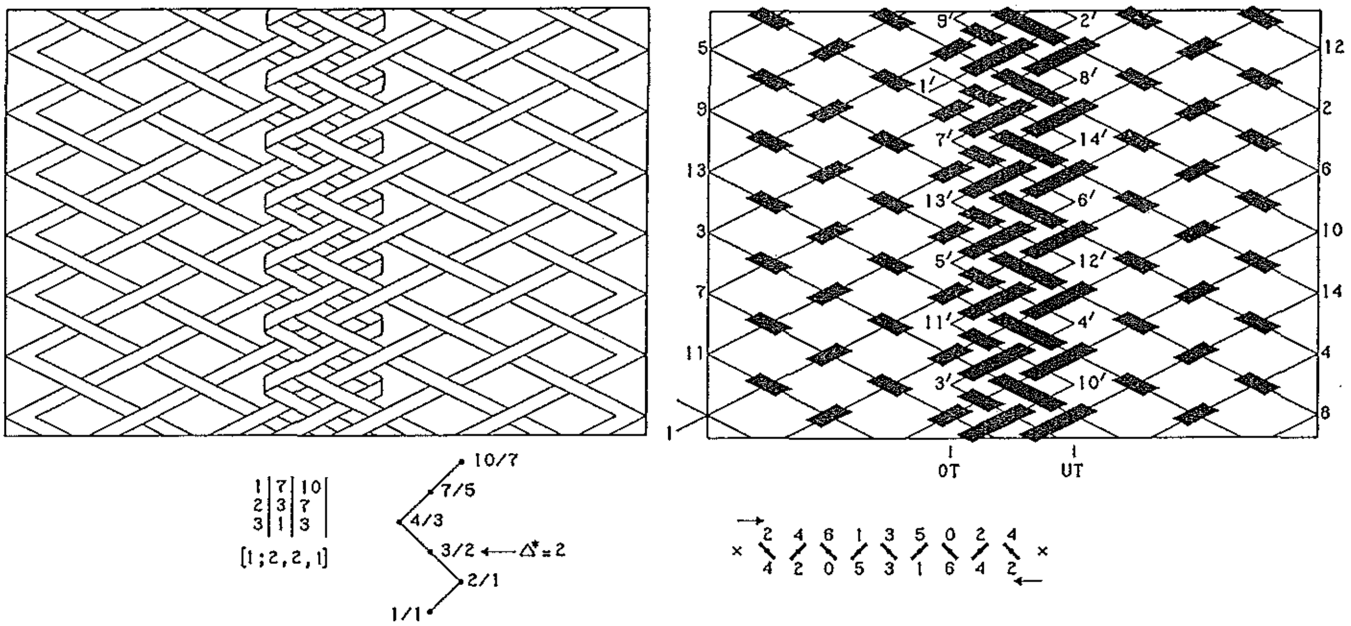

Fig. 901 — A Regular Knot interbraided with a cylindrical UT-OT element.

The algorithm diagram of the Regular Knot gives us the following half-cycle braiding algorithms:

half-cycle 1: Free run.
half-cycle 2: $i = 0$: o.
half-cycle 3: $i = 0$: u.
half-cycle 4: $i \leq 1$: $u - o$.
half-cycle 5: $i \leq 1$: $o - u$.
half-cycle 6: $i \leq 2$: $o - u - o - u$.
half-cycle 7: $i \leq 2$: $u - o - u - o$.
half-cycle 8: $i \leq 3$: $o - u - 2o - u$.
half-cycle 9: $i \leq 3$: $u - o - 2u - o$.
half-cycle 10: $i \leq 4$: $o - 2u - 2o - u - o$.
half-cycle 11: $i \leq 4$: $u - 2o - 2u - o - u$.
half-cycle 12: $i \leq 5$: $o - 2u - o - u - o - u - o$.
half-cycle 13: $i \leq 5$: $u - 2o - u - o - u - o - u$.
half-cycle 14: $i \leq 6$: $o - u - o - u - o - u - o - u - o$.

The half-cycle braiding algorithms for the interbraided OT-UT element are as follows:

half-cycle 1′: $o - u$.
half-cycle 2′: UT — $u - o$.
half-cycle 3′: OT — $o - u$.
half-cycle 4′: UT — $u - o$.
half-cycle 5′: OT — $o - u$.
half-cycle 6′: UT — $u - o$.
half-cycle 7′: OT — $o - u$.

half-cycle $8'$: UT — $2u - o$.
half-cycle $9'$: OT — $2o - u$.
half-cycle $10'$: UT — $2u - o$.
half-cycle $11'$: OT — $2o - u$.
half-cycle $12'$: UT — $2u - o$.
half-cycle $13'$: OT — $2o - u$.
half-cycle $14'$: UT — $2u - o$.

When the grain-side of half-cycle 1 and the grain-side of half-cycle $1'$ are uppermost, the finished knot will have the grain-side uppermost. Note that the OT-UT interbraid has a right helix and hence it will show a right helix in the finished knot.

In Fig. 902 the interbraided cylindrical braids have each the OT elements incorporated in one of their bight-boundaries. Hence the **right** bight-edge of the **left** interbraided cylindrical braid shows a **left** helix and the **left** bight-edge of the **right** interbraided cylindrical braid shows a **right** helix. Thus when half-cycle 1 has the grain-side uppermost then also the half-cycles 4, 5 ; 8, 9 ; 12, 13 have the grain-side uppermost, while the half-cycles 2, 3 ; 6, 7 ; 10, 11 ; 14 have the flesh-side uppermost. The end of half-cycle 14 goes over into half-cycle 1, hence the flesh-side of half-cycle 14 goes over into the grain-side of half-cycle 1. Since such a surface change is undesirable, we should ensure that for strings in which the two opposing surfaces differ, the number of bights for each cylindrical braid is **even**; this will then also ensure that the surface pattern in each cylindrical braid is regular.

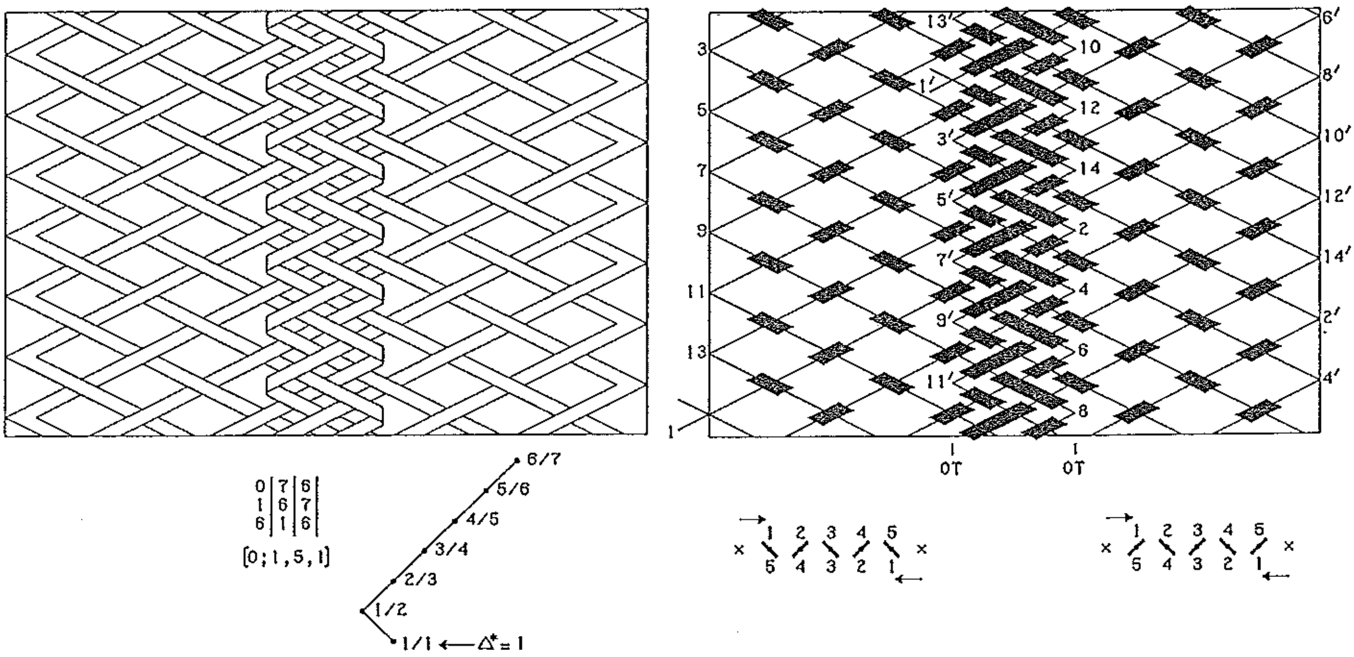

Fig. 902 — Two Regular Knots with their OT bight-edges interbraided.

The algorithm diagrams of the Regular Knots involved give us the following half-cycle braiding algorithms (note that the algorithm diagrams are associated with the Regular Knots involved and do not show codings associated with interbraiding):

half-cycle 1: Free run.
half-cycle 2: $i = 0$: OT — Free run.
half-cycle 3: $i = 0$: Free run.
half-cycle 4: $i \leq 1$: OT — o.

half-cycle 5: $i \le 1$: u.
half-cycle 6: $i \le 2$: OT — $o - u$.
half-cycle 7: $i \le 2$: $u - o$.
half-cycle 8: $i \le 3$: OT — $o - u - o$.
half-cycle 9: $i \le 3$: $u - o - u$.
half-cycle 10: $i \le 4$: OT — $o - u - o - u$.
half-cycle 11: $i \le 4$: $u - o - u - o$.
half-cycle 12: $i \le 5$: OT — $o - u - o - u - o$.
half-cycle 13: $i \le 5$: $u - o - u - o - u$.
half-cycle 14: $i \le 6$: OT — $o - u - o - u - o$.

---

half-cycle 1': $o - u$.
half-cycle 2': $i = 0$: $u - o$.
half-cycle 3': $i = 0$: OT — $o - u$.
half-cycle 4': $i \le 1$: $2u - o$.
half-cycle 5': $i \le 1$: OT — $2o - u$.
half-cycle 6': $i \le 2$: $u - o - u - o$.
half-cycle 7': $i \le 2$: OT — $2o - 2u$.
half-cycle 8': $i \le 3$: $u - o - 2u - o$.
half-cycle 9': $i \le 3$: OT — $2o - 2u - o$.
half-cycle 10': $i \le 4$: $u - o - u - o - u - o$.
half-cycle 11': $i \le 4$: OT — $2o - 2u - o - u$.
half-cycle 12': $i \le 5$: $u - o - u - o - 2u - o$.
half-cycle 13': $i \le 5$: OT — $2o - 2u - o - u - o$.
half-cycle 14': $i \le 6$: $u - o - u - o - 2u - o$.

In Fig. 903 the two Regular Knots with their interbraided OT bight-edges have each 8 bights, hence a desired **even** number of bights.

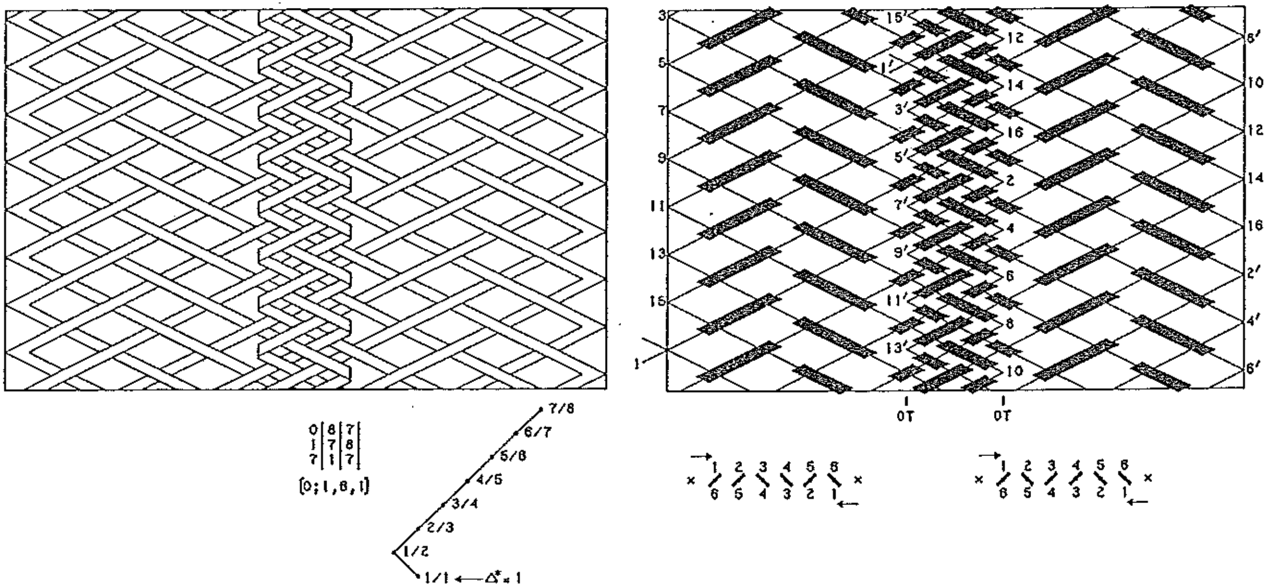

Fig. 903 — Two Regular Knots with their OT bight-edges interbraided.

The half-cycle braiding algorithms involved are read from their algorithm diagrams (note that the algorithm diagrams are associated with the Regular Knots involved and do not show codings associated with interbraiding):

half-cycle 1: Free run.

half-cycle 2 : $i = 0$: OT — Free run.
half-cycle 3 : $i = 0$: Free run.
half-cycle 4 : $i \leq 1$: OT — o.
half-cycle 5 : $i \leq 1$: o.
half-cycle 6 : $i \leq 2$: OT — $o - u$.
half-cycle 7 : $i \leq 2$: $2o$.
half-cycle 8 : $i \leq 3$: OT — $o - u - o$.
half-cycle 9 : $i \leq 3$: $2o - u$.
half-cycle 10 : $i \leq 4$: OT — $o - u - 2o$.
half-cycle 11 : $i \leq 4$: $2o - 2u$.
half-cycle 12 : $i \leq 5$: OT — $o - u - 2o - u$.
half-cycle 13 : $i \leq 5$: $2o - 2u - o$.
half-cycle 14 : $i \leq 6$: OT — $o - u - 2o - 2u$.
half-cycle 15 : $i \leq 6$: $2o - 2u - o - u$.
half-cycle 16 : $i \leq 7$: OT — $o - u - 2o - 2u$.

half-cycle 1′ : $o - u$.
half-cycle 2′ : $i = 0$: $u - o$.
half-cycle 3′ : $i = 0$: OT — $o - u$.
half-cycle 4′ : $i \leq 1$: $o - u - o$.
half-cycle 5′ : $i \leq 1$: OT — $2o - u$.
half-cycle 6′ : $i \leq 2$: $2o - u - o$.
half-cycle 7′ : $i \leq 2$: OT — $2o - 2u$.
half-cycle 8′ : $i \leq 3$: $2o - 2u - o$.
half-cycle 9′ : $i \leq 3$: OT — $2o - 2u - o$.
half-cycle 10′ : $i \leq 4$: $2o - 3u - o$.
half-cycle 11′ : $i \leq 4$: OT — $2o - 2u - 2o$.
half-cycle 12′ : $i \leq 5$: $2o - 2u - o - u - o$.
half-cycle 13′ : $i \leq 5$: OT — $2o - 2u - 2o - u$.
half-cycle 14′ : $i \leq 6$: $2o - 2u - o - 2u - o$.
half-cycle 15′ : $i \leq 6$: OT — $2o - 2u - 2o - 2u$.
half-cycle 16′ : $i \leq 7$: $2o - 2u - o - 2u - o$.

These braids with OT elements or OT-UT elements should not be confused with Crocodile Ridge braids which so commonly happens in the various publications on braiding. Crocodile Ridge braids do not contain OT or OT-UT elements, and hence the grain-side of the strings in these braids can always be uppermost.[†]

The cylindrical braid in Fig. 904 consists of three components, each with eight bights: the left component has its right bight-edge with OT elements interbraided with the left bight-edge with OT elements of the central component while this central component has its right bight-edge with OT elements interbraided with the left bight-edge with OT elements of the right component. By using the same string-colour for the left and the right component and a different string-colour for the central component, a beautiful knot will be obtained.

[†] It cannot be stressed enough that in braiding the nomenclature should inherently be associated with flat braiding material. Round braiding material tends to hide OT and UT elements and consequently for round-string braids the difference between braids with these elements and Crocodile Ridge braids tends to disappear.

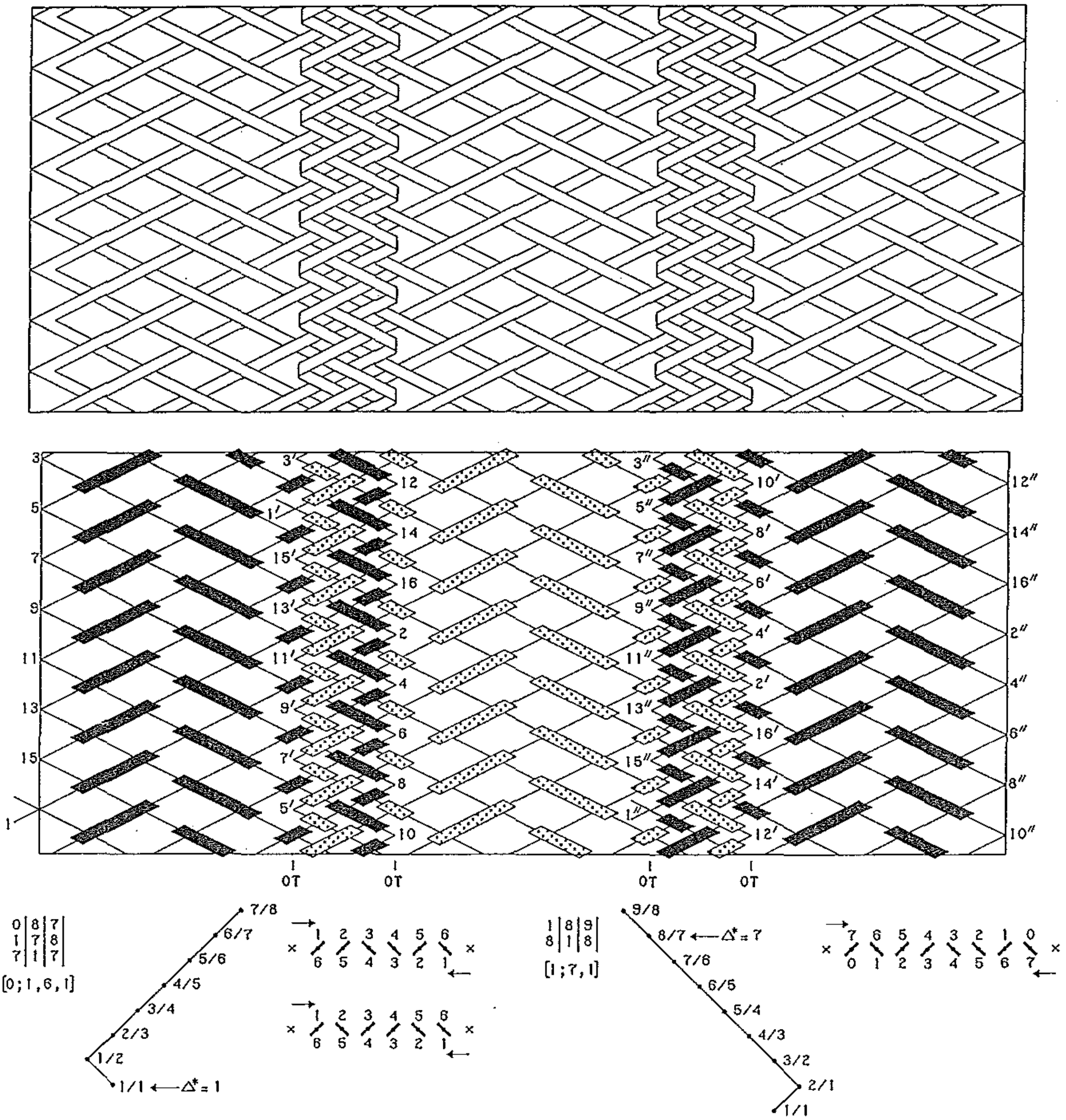

Fig. 904 — Interbraided OT bight-edges.

From the algorithm diagrams of the components we can again obtain the various half-cycle braiding algorithms (note that the algorithm diagrams are associated with the Regular Knots involved and do not show codings associated with interbraiding):

half-cycle 1: Free run.
half-cycle 2: $i = 0$: OT — Free run.
half-cycle 3: $i = 0$: Free run.
half-cycle 4: $i \leq 1$: OT — o.
half-cycle 5: $i \leq 1$: o.
half-cycle 6: $i \leq 2$: OT — $o - u$.
half-cycle 7: $i \leq 2$: $2o$.

half-cycle 8: $i \leq 3$: OT — $o - u - o$.
half-cycle 9: $i \leq 3$: $2o - u$.
half-cycle 10: $i \leq 4$: OT — $o - u - 2o$.
half-cycle 11: $i \leq 4$: $2o - 2u$.
half-cycle 12: $i \leq 5$: OT — $o - u - 2o - u$.
half-cycle 13: $i \leq 5$: $2o - 2u - o$.
half-cycle 14: $i \leq 6$: OT — $o - u - 2o - 2u$.
half-cycle 15: $i \leq 6$: $2o - 2u - o - u$.
half-cycle 16: $i \leq 7$: OT — $o - u - 2o - 2u$.

half-cycle 1′: $o - u$.
half-cycle 2′: $i = 0$: OT — $2u - o$.
half-cycle 3′: $i = 0$: OT — $o - 2u$.
half-cycle 4′: $i \leq 1$: OT — $o - 2u - o$.
half-cycle 5′: $i \leq 1$: OT — $o - u - o - u$.
half-cycle 6′: $i \leq 2$: OT — $u - o - 2u - o$.
half-cycle 7′: $i \leq 2$: OT — $o - 2u - o - u$.
half-cycle 8′: $i \leq 3$: OT — $2u - o - 2u - o$.
half-cycle 9′: $i \leq 3$: OT — $o - 3u - o - u$.
half-cycle 10′: $i \leq 4$: OT — $o - 2u - o - 2u - o$.
half-cycle 11′: $i \leq 4$: OT — $o - u - o - 2u - o - u$.
half-cycle 12′: $i \leq 5$: OT — $2o - 2u - o - 2u - o$.
half-cycle 13′: $i \leq 5$: OT — $o - u - 2o - 2u - o - u$.
half-cycle 14′: $i \leq 6$: OT — $u - 2o - 2u - o - 2u - o$.
half-cycle 15′: $i \leq 6$: OT — $o - 2u - 2o - 2u - o - u$.
half-cycle 16′: $i \leq 7$: OT — $o - u - 2o - 2u - o - 2u - o$.

half-cycle 1″: $o - u$.
half-cycle 2″: $i = 0$: $u - o$.
half-cycle 3″: $i = 0$: OT — $o - u$.
half-cycle 4″: $i \leq 1$: $o - u - o$.
half-cycle 5″: $i \leq 1$: OT — $2o - u$.
half-cycle 6″: $i \leq 2$: $2o - u - o$.
half-cycle 7″: $i \leq 2$: OT — $2o - 2u$.
half-cycle 8″: $i \leq 3$: $2o - 2u - o$.
half-cycle 9″: $i \leq 3$: OT — $2o - 2u - o$.
half-cycle 10″: $i \leq 4$: $2o - 3u - o$.
half-cycle 11″: $i \leq 4$: OT — $2o - 2u - 2o$.
half-cycle 12″: $i \leq 5$: $2o - 2u - o - u - o$.
half-cycle 13″: $i \leq 5$: OT — $2o - 2u - 2o - u$.
half-cycle 14″: $i \leq 6$: $2o - 2u - o - 2u - o$.
half-cycle 15″: $i \leq 6$: OT — $2o - 2u - 2o - 2u$.
half-cycle 16″: $i \leq 7$: $2o - 2u - o - 2u - o$.

In the cylindrical braid of Fig. 905 the left and right components have been extended, which improves the appearance. Its associated half-cycle braiding algorithms are:

half-cycle 1: Free run.
half-cycle 2: $i = 0$: OT — o.
half-cycle 3: $i = 0$: u.
half-cycle 4: $i \leq 1$: OT — $2o$.

half-cycle 5: $i \leq 1$: $o - u$.
half-cycle 6: $i \leq 2$: OT — $u - 2o$.
half-cycle 7: $i \leq 2$: $u - o - u$.
half-cycle 8: $i \leq 3$: OT — $2u - 2o$.
half-cycle 9: $i \leq 3$: $2u - o - u$.
half-cycle 10: $i \leq 4$: OT — $o - 2u - 2o$.
half-cycle 11: $i \leq 4$: $o - 2u - o - u$.
half-cycle 12: $i \leq 5$: OT — $2o - 2u - 2o$.
half-cycle 13: $i \leq 5$: $2o - 2u - o - u$.
half-cycle 14: $i \leq 6$: OT — $u - 2o - 2u - 2o$.
half-cycle 15: $i \leq 6$: $u - 2o - 2u - o - u$.
half-cycle 16: $i \leq 7$: OT — $o - u - 2o - 2u - 2o$.

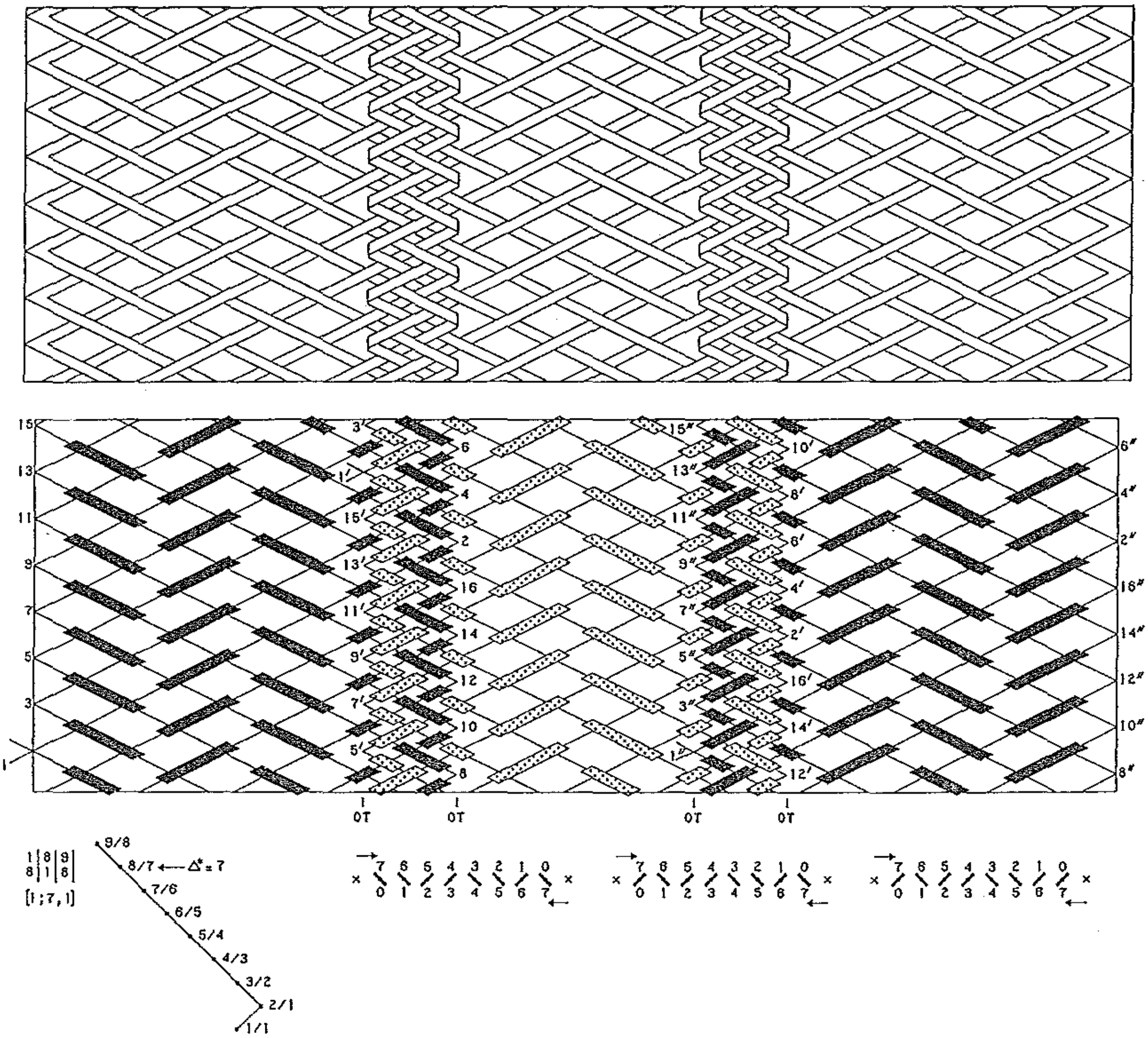

Fig. 905 — Interbraided OT bight-edges.

half-cycle 1′: $o - u$.
half-cycle 2′: $i = 0$: OT — $2u - o$.
half-cycle 3′: $i = 0$: OT — $o - 2u$.
half-cycle 4′: $i \leq 1$: OT — $o - 2u - o$.
half-cycle 5′: $i \leq 1$: OT — $o - u - o - u$.

half-cycle $6'$: $i \leq 2$: OT — $u - o - 2u - o$.
half-cycle $7'$: $i \leq 2$: OT — $o - 2u - o - u$.
half-cycle $8'$: $i \leq 3$: OT — $2u - o - 2u - o$.
half-cycle $9'$: $i \leq 3$: OT — $o - 3u - o - u$.
half-cycle $10'$: $i \leq 4$: OT — $o - 2u - o - 2u - o$.
half-cycle $11'$: $i \leq 4$: OT — $o - u - o - 2u - o - u$.
half-cycle $12'$: $i \leq 5$: OT — $2o - 2u - o - 2u - o$.
half-cycle $13'$: $i \leq 5$: OT — $o - u - 2o - 2u - o - u$.
half-cycle $14'$: $i \leq 6$: OT — $u - 2o - 2u - o - 2u - o$.
half-cycle $15'$: $i \leq 6$: OT — $o - 2u - 2o - 2u - o - u$.
half-cycle $16'$: $i \leq 7$: OT — $o - u - 2o - 2u - o - 2u - o$.

half-cycle $1''$: $o - u$.
half-cycle $2''$: $i = 0$: $2u - o$.
half-cycle $3''$: $i = 0$: OT — $o - u - o$.
half-cycle $4''$: $i \leq 1$: $o - 2u - o$.
half-cycle $5''$: $i \leq 1$: OT — $o - u - 2o$.
half-cycle $6''$: $i \leq 2$: $u - o - 2u - o$.
half-cycle $7''$: $i \leq 2$: OT — $o - 2u - 2o$.
half-cycle $8''$: $i \leq 3$: $2u - o - 2u - o$.
half-cycle $9''$: $i \leq 3$: OT — $o - 3u - 2o$.
half-cycle $10''$: $i \leq 4$: $o - 2u - o - 2u - o$.
half-cycle $11''$: $i \leq 4$: OT — $o - u - o - 2u - 2o$.
half-cycle $12''$: $i \leq 5$: $2o - 2u - o - 2u - o$.
half-cycle $13''$: $i \leq 5$: OT — $o - u - 2o - 2u - 2o$.
half-cycle $14''$: $i \leq 6$: $u - 2o - 2u - o - 2u - o$.
half-cycle $15''$: $i \leq 6$: OT — $o - 2u - 2o - 2u - 2o$.
half-cycle $16''$: $i \leq 7$: $2u - 2o - 2u - o - 2u - o$.

The interbraided cylindrical OT-UT braid in Fig. 901 shows in the finished knot as a right helix, hence in order to balance its appearance we can add an interbraided cylindrical UT-OT braid which shows in the finished knot as a left helix. This has been done in Fig. 906, resulting in another beautiful knot. Its half-cycle braiding algorithms are as follows:

half-cycle 1: Free run.
half-cycle 2: $i = 0$: o.
half-cycle 3: $i = 0$: o.
half-cycle 4: $i \leq 1$: $u - 2o$.
half-cycle 5: $i \leq 1$: $u - 2o$.
half-cycle 6: $i \leq 2$: $u - 3o$.
half-cycle 7: $i \leq 2$: $u - 3o$.
half-cycle 8: $i \leq 3$: $o - u - 2o - u - o$.
half-cycle 9: $i \leq 3$: $o - u - 2o - u - o$.
half-cycle 10: $i \leq 4$: $o - u - 3o - u - o - u$.
half-cycle 11: $i \leq 4$: $o - u - 3o - u - o - u$.
half-cycle 12: $i \leq 5$: $o - u - 4o - u - o - u$.
half-cycle 13: $i \leq 5$: $o - u - 2o - u - o - u - o - u$.
half-cycle 14: $i \leq 6$: $2o - u - 4o - 2u - o - u$.
half-cycle 15: $i \leq 6$: $2o - u - 2o - u - o - 2u - o - u$.
half-cycle 16: $i \leq 7$: $2o - u - 5o - 2u - o - 2u$.

half-cycle 17: $i \leq 7$: $2o - u - 3o - u - o - 2u - o - 2u$.
half-cycle 18: $i \leq 8$: $2o - u - 4o - u - o - 2u - o - 2u$.
half-cycle 19: $i \leq 8$: $2o - u - 3o - 2u - o - 2u - o - 2u$.
half-cycle 20: $i \leq 9$: $2o - 2u - 4o - u - o - 2u - 2o - 2u$.
half-cycle 21: $i \leq 9$: $2o - 2u - 3o - 2u - o - 2u - 2o - 2u$.
half-cycle 22: $i \leq 10$: $2o - 2u - 2o - u - 2o - u - o - 2u - 2o - 2u$.

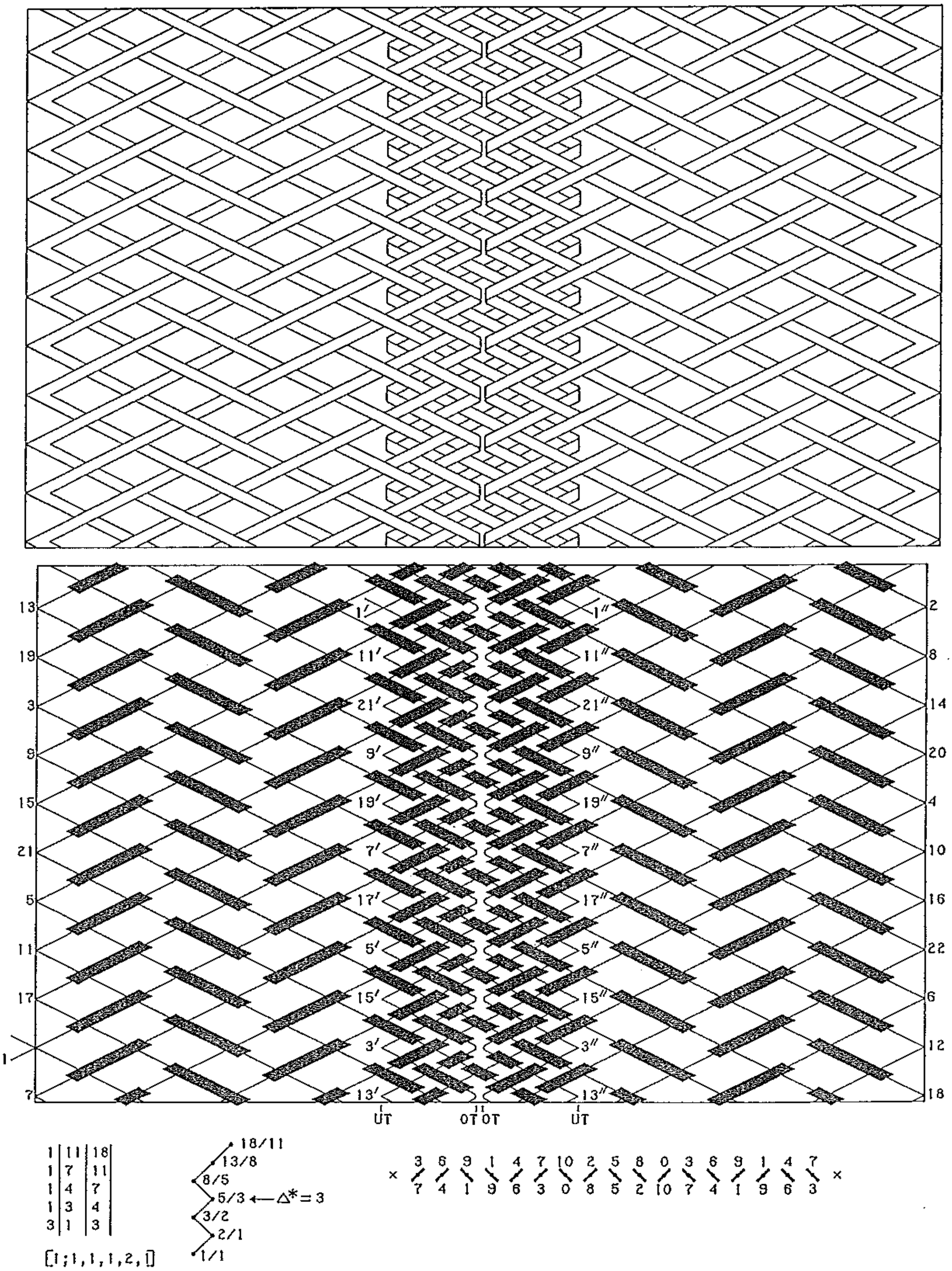

Fig. 906 — Two interbraided cylindrical UT-OT braids.

half-cycle $1'$: $u - o$.
half-cycle $2'$: OT — $o - u$.
half-cycle $3'$: UT — $u - o$.
half-cycle $4'$: OT — $o - u$.
half-cycle $5'$: UT — $u - o$.
half-cycle $6'$: OT — $o - u$.
half-cycle $7'$: UT — $u - o$.
half-cycle $8'$: OT — $o - u$.
half-cycle $9'$: UT — $u - o$.
half-cycle $10'$: OT — $o - u$.
half-cycle $11'$: UT — $u - o$.
half-cycle $12'$: OT — $2o - u$.
half-cycle $13'$: UT — $2u - o$.
half-cycle $14'$: OT — $2o - u$.
half-cycle $15'$: UT — $2u - o$.
half-cycle $16'$: OT — $2o - u$.
half-cycle $17'$: UT — $2u - o$.
half-cycle $18'$: OT — $2o - u$.
half-cycle $19'$: UT — $2u - o$.
half-cycle $20'$: OT — $2o - u$.
half-cycle $21'$: UT — $2u - o$.
half-cycle $22'$: OT — $2o - u$.

half-cycle $1''$: $u - o$.
half-cycle $2''$: OT — $o - u$.
half-cycle $3''$: UT — $u - o$.
half-cycle $4''$: OT — $o - u$.
half-cycle $5''$: UT — $u - o$.
half-cycle $6''$: OT — $o - u$.
half-cycle $7''$: UT — $u - o$.
half-cycle $8''$: OT — $o - u$.
half-cycle $9''$: UT — $u - o$.
half-cycle $10''$: OT — $o - u$.
half-cycle $11''$: UT — $u - o$.
half-cycle $12''$: OT — $2o - u$.
half-cycle $13''$: UT — $2u - o$.
half-cycle $14''$: OT — $2o - u$.
half-cycle $15''$: UT — $2u - o$.
half-cycle $16''$: OT — $2o - u$.
half-cycle $17''$: UT — $2u - o$.
half-cycle $18''$: OT — $2o - u$.
half-cycle $19''$: UT — $2u - o$.
half-cycle $20''$: OT — $2o - u$.
half-cycle $21''$: UT — $2u - o$.
half-cycle $22''$: OT — $2o - u$.

In Fig. 907 the left-hand Asymmetric Regular Knot with $A_l = 2$, $A_r = 1$, $x = 11$ has an OT right bight-boundary while the right-hand Asymmetric Regular Knot with $A_l = 1$, $A_r = 2$, $x = 11$ has an OT left bight-boundary. This beautiful knot can be braided over an oval or a conical foundation. Its half-cycle braiding algorithms are:

half-cycle 1 : $L_1 \longrightarrow R$: Free run.
half-cycle 2 : $R \longrightarrow L_2$: OT — u.
half-cycle 3 : $L_2 \longrightarrow R$: u.
half-cycle 4 : $R \longrightarrow L_1$: OT — $2o$.
half-cycle 5 : $L_1 \longrightarrow R$: $u - o$.
half-cycle 6 : $R \longrightarrow L_2$: OT — $u - o - u$.
half-cycle 7 : $L_2 \longrightarrow R$: $2o - u$.
half-cycle 8 : $R \longrightarrow L_1$: OT — $4o$.
half-cycle 9 : $L_1 \longrightarrow R$: $u - o - u - o$.
half-cycle 10 : $R \longrightarrow L_2$: OT — $u - o - u - o - u$.
half-cycle 11 : $L_2 \longrightarrow R$: $4o - u$.
half-cycle 12 : $R \longrightarrow L_1$: OT — $o - u - 4o - u$.
half-cycle 13 : $L_1 \longrightarrow R$: $o - u - o - u - 2o - u$.
half-cycle 14 : $R \longrightarrow L_2$: OT — $u - o - u - 2o - 2u$.
half-cycle 15 : $L_2 \longrightarrow R$: $4o - u - o - u$.
half-cycle 16 : $R \longrightarrow L_1$: OT — $o - u - 2o - 2u - 2o - u$.
half-cycle 17 : $L_1 \longrightarrow R$: $o - u - 2o - 2u - 2o - u$.
half-cycle 18 : $R \longrightarrow L_2$: OT — $u - 2o - 2u - 2o - 2u$.
half-cycle 19 : $L_2 \longrightarrow R$: $2o - 2u - 2o - u - o - u$.
half-cycle 20 : $R \longrightarrow L_1$: OT — $o - 3u - 2o - 2u - 2o - u$.

half-cycle $1'$: $R_1 \longrightarrow L$: $u - o$.
half-cycle $2'$: $L \longrightarrow R_2$: OT — $o - 2u$.

half-cycle $3'$: $R_2 \longrightarrow L$: $2u - o$.
half-cycle $4'$: $L \longrightarrow R_1$: OT — $o - u - 2o$.
half-cycle $5'$: $R_1 \longrightarrow L$: $u - o - u - o$.
half-cycle $6'$: $L \longrightarrow R_2$: OT — $o - 2u - o - u$.
half-cycle $7'$: $R_2 \longrightarrow L$: $2o - 2u - o$.
half-cycle $8'$: $L \longrightarrow R_1$: OT — $o - u - 4o$.
half-cycle $9'$: $R_1 \longrightarrow L$: $u - o - u - o - u - o$.
half-cycle $10'$: $L \longrightarrow R_2$: OT — $o - 2u - o - u - o - u$.
half-cycle $11'$: $R_2 \longrightarrow L$: $4o - 2u - o$.
half-cycle $12'$: $L \longrightarrow R_1$: OT — $2o - 2u - 4o - u$.
half-cycle $13'$: $R_1 \longrightarrow L$: $o - u - o - u - 2o - 2u - o$.
half-cycle $14'$: $L \longrightarrow R_2$: OT — $o - 2u - o - u - 2o - 2u$.
half-cycle $15'$: $R_2 \longrightarrow L$: $4o - u - o - 2u - o$.
half-cycle $16'$: $L \longrightarrow R_1$: OT — $2o - 2u - 2o - 2u - 2o - u$.
half-cycle $17'$: $R_1 \longrightarrow L$: $o - u - 2o - 2u - 2o - 2u - o$.
half-cycle $18'$: $L \longrightarrow R_2$: OT — $o - 2u - 2o - 2u - 2o - 2u$.
half-cycle $19'$: $R_2 \longrightarrow L$: $2o - 2u - 2o - u - o - 2u - o$.
half-cycle $20'$: $L \longrightarrow R_1$: OT — $2o - 4u - 2o - 2u - 2o - u$.

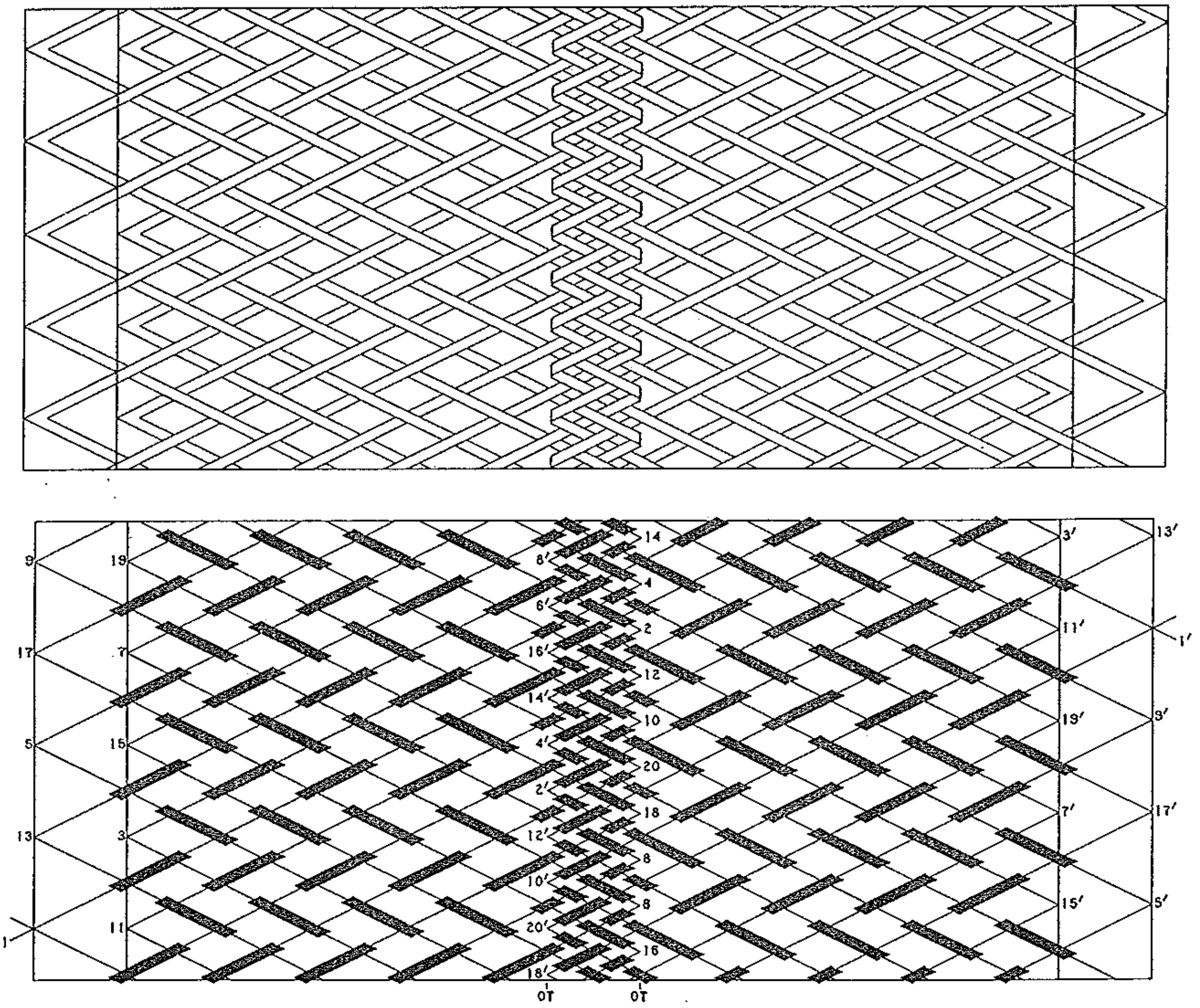

Fig. 907 — OT-edge interbraid of two Asymmetric Regular Nested Knots.

Fig. 908 shows an alternative coding along the sides of the interbraiding.

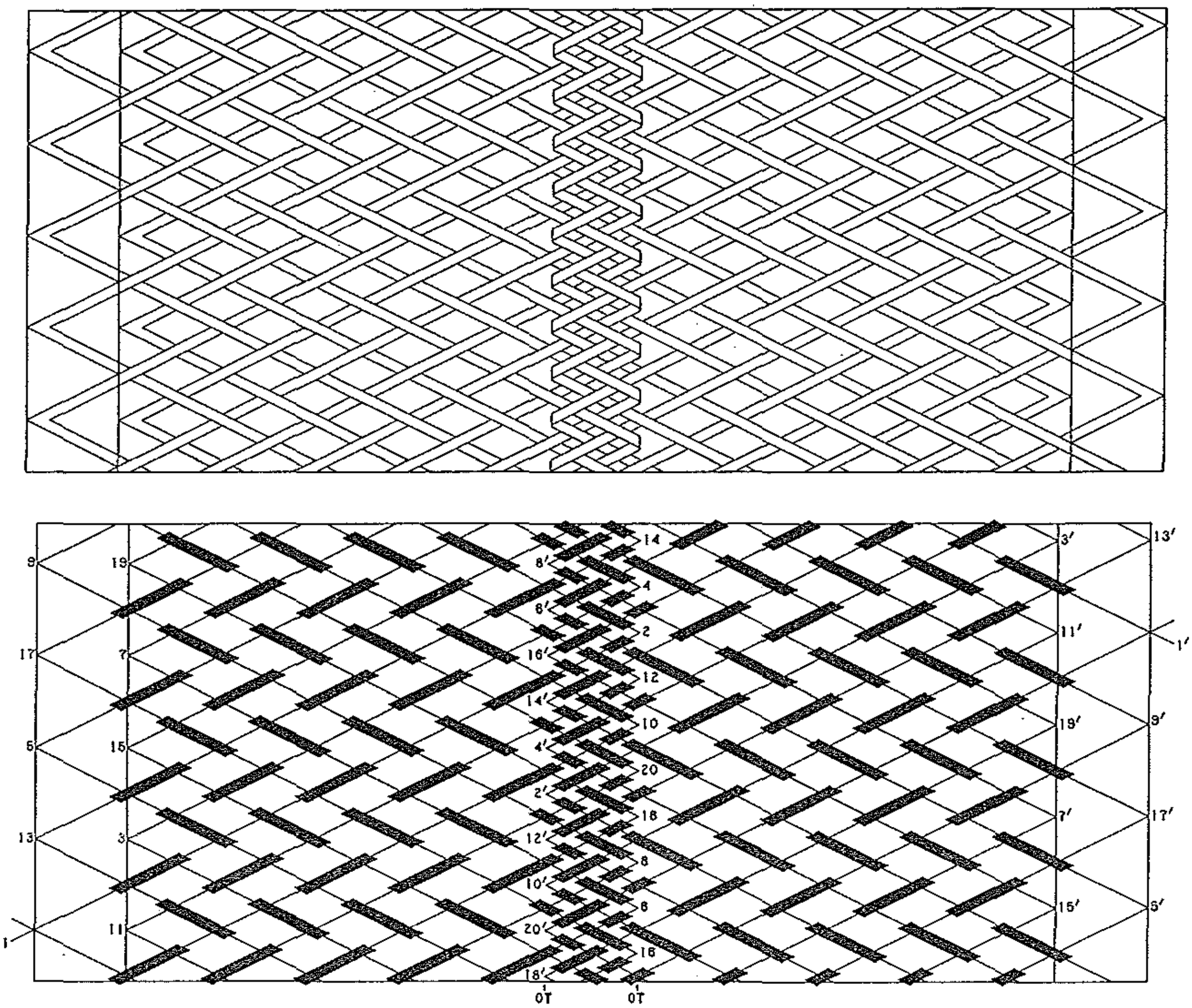

Fig. 908 — OT-edge interbraid of two Asymmetric Regular Nested Knots.

The associated half-cycle braiding algorithms are:

half-cycle 1 : $L_1 \longrightarrow R$: Free run.
half-cycle 2 : $R \longrightarrow L_2$: OT — u.
half-cycle 3 : $L_2 \longrightarrow R$: u.
half-cycle 4 : $R \longrightarrow L_1$: OT — $2o$.
half-cycle 5 : $L_1 \longrightarrow R$: $u - o$.
half-cycle 6 : $R \longrightarrow L_2$: OT — $u - o - u$.
half-cycle 7 : $L_2 \longrightarrow R$: $2o - u$.
half-cycle 8 : $R \longrightarrow L_1$: OT — $4o$.
half-cycle 9 : $L_1 \longrightarrow R$: $u - o - u - o$.
half-cycle 10 : $R \longrightarrow L_2$: OT — $u - o - u - o - u$.
half-cycle 11 : $L_2 \longrightarrow R$: $4o - u$.
half-cycle 12 : $R \longrightarrow L_1$: OT — $6o - u$.
half-cycle 13 : $L_1 \longrightarrow R$: $o - u - o - u - 2o - u$.
half-cycle 14 : $R \longrightarrow L_2$: OT — $u - o - u - 2o - 2u$.
half-cycle 15 : $L_2 \longrightarrow R$: $4o - 3u$.
half-cycle 16 : $R \longrightarrow L_1$: OT — $4o - 2u - 2o - u$.
half-cycle 17 : $L_1 \longrightarrow R$: $o - u - 2o - 2u - 2o - u$.

half-cycle 18 : $R \longrightarrow L_2$: OT — $u - 2o - 2u - 2o - 2u$.
half-cycle 19 : $L_2 \longrightarrow R$: $2o - 2u - 2o - 3u$.
half-cycle 20 : $R \longrightarrow L_1$: OT — $2o - 2u - 2o - 2u - 2o - u$.

half-cycle 1′ : $R_1 \longrightarrow L$: $u - o$.
half-cycle 2′ : $L \longrightarrow R_2$: OT — $o - 2u$.
half-cycle 3′ : $R_2 \longrightarrow L$: $2u - o$.
half-cycle 4′ : $L \longrightarrow R_1$: OT — $o - u - 2o$.
half-cycle 5′ : $R_1 \longrightarrow L$: $u - o - u - o$.
half-cycle 6′ : $L \longrightarrow R_2$: OT — $o - 2u - o - u$.
half-cycle 7′ : $R_2 \longrightarrow L$: $2o - 2u - o$.
half-cycle 8′ : $L \longrightarrow R_1$: OT — $o - u - 4o$.
half-cycle 9′ : $R_1 \longrightarrow L$: $u - o - u - o - u - o$.
half-cycle 10′ : $L \longrightarrow R_2$: OT — $o - 2u - o - u - o - u$.
half-cycle 11′ : $R_2 \longrightarrow L$: $4o - 2u - o$.
half-cycle 12′ : $L \longrightarrow R_1$: OT — $2o - u - 5o - u$.
half-cycle 13′ : $R_1 \longrightarrow L$: $o - u - o - u - 2o - 2u - o$.
half-cycle 14′ : $L \longrightarrow R_2$: OT — $o - 2u - o - u - 2o - 2u$.
half-cycle 15′ : $R_2 \longrightarrow L$: $4o - 4u - o$.
half-cycle 16′ : $L \longrightarrow R_1$: OT — $2o - u - 3o - 2u - 2o - u$.
half-cycle 17′ : $R_1 \longrightarrow L$: $o - u - 2o - 2u - 2o - 2u - o$.
half-cycle 18′ : $L \longrightarrow R_2$: OT — $o - 2u - 2o - 2u - 2o - 2u$.
half-cycle 19′ : $R_2 \longrightarrow L$: $2o - 2u - 2o - 4u - o$.
half-cycle 20′ : $L \longrightarrow R_1$: OT — $2o - u - o - 2u - 2o - 2u - 2o - u$.

⋆⋆ *Asymmetric Regular Nested Cylindrical Braids where the* $A = 1$ *bight-edges with OT bight-elements are interwoven can be used in many applications and hence it is important to know their string-run relationships. Derive the relationships between first-return string-runs, the number of essential components and the* $A > 1$ *bight-edge.*

By combining the knot in Fig. 908 with its mirror-image, we obtain the knot in Fig. 909. Note that since the right-hand knot in Fig. 908 has an odd-number of nests on its right bight-edge and requires one essential string, its combined mirror-imaged knot (the central knot in Fig. 909) requires also one essential string. The braiding half-cycle algorithms associated with the knot in Fig. 909 are as follows:

half-cycle 1 : $L_1 \longrightarrow R$: Free run.
half-cycle 2 : $R \longrightarrow L_2$: OT — u.
half-cycle 3 : $L_2 \longrightarrow R$: u.
half-cycle 4 : $R \longrightarrow L_1$: OT — $2o$.
half-cycle 5 : $L_1 \longrightarrow R$: $u - o$.
half-cycle 6 : $R \longrightarrow L_2$: OT — $u - o - u$.
half-cycle 7 : $L_2 \longrightarrow R$: $2o - u$.
half-cycle 8 : $R \longrightarrow L_1$: OT — $4o$.
half-cycle 9 : $L_1 \longrightarrow R$: $u - o - u - o$.
half-cycle 10 : $R \longrightarrow L_2$: OT — $u - o - u - o - u$.
half-cycle 11 : $L_2 \longrightarrow R$: $4o - u$.
half-cycle 12 : $R \longrightarrow L_1$: OT — $6o - u$.
half-cycle 13 : $L_1 \longrightarrow R$: $o - u - o - u - 2o - u$.
half-cycle 14 : $R \longrightarrow L_2$: OT — $u - o - u - 2o - 2u$.
half-cycle 15 : $L_2 \longrightarrow R$: $4o - 3u$.

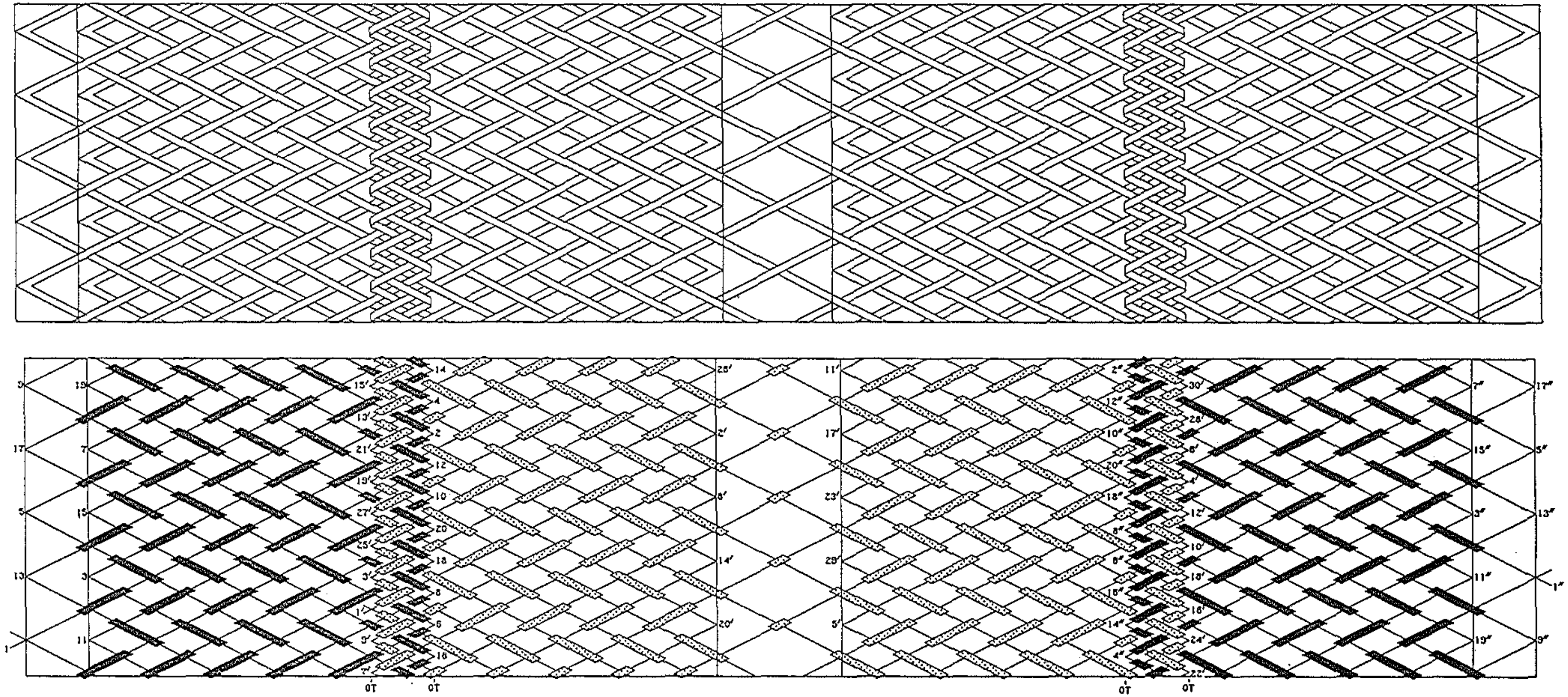

Fig. 909 — Combining the mirror-image of Fig. 908 with Fig. 908.

half-cycle 16 : $R \longrightarrow L_1$: OT — $4o - 2u - 2o - u$.
half-cycle 17 : $L_1 \longrightarrow R$: $o - u - 2o - 2u - 2o - u$.
half-cycle 18 : $R \longrightarrow L_2$: OT — $u - 2o - 2u - 2o - 2u$.
half-cycle 19 : $L_2 \longrightarrow R$: $2o - 2u - 2o - 3u$.
half-cycle 20 : $R \longrightarrow L_1$: OT — $2o - 2u - 2o - 2u - 2o - u$.

half-cycle 1′ : $L \longrightarrow C_L$: $o - u$.
half-cycle 2′ : $C_L \longrightarrow L$: $2u - o$.
half-cycle 3′ : $L \longrightarrow R$: OT — $o - u - o$.
half-cycle 4′ : $R \longrightarrow C_R$: OT — u.
half-cycle 5′ : $C_R \longrightarrow R$: u.
half-cycle 6′ : $R \longrightarrow L$: OT — $u - o - u - o - u - o$.
half-cycle 7′ : $L \longrightarrow C_L$: OT — $o - u - o - u$.
half-cycle 8′ : $C_L \longrightarrow L$: $2o - u - o$.
half-cycle 9′ : $L \longrightarrow R$: OT — $o - u - 3o - 2u$.
half-cycle 10′ : $R \longrightarrow C_R$: OT — $3u$.
half-cycle 11′ : $C_R \longrightarrow R$: $u - o - u$.
half-cycle 12′ : $R \longrightarrow L$: OT — $2o - u - 2o - u - 2o - 2u - o$.
half-cycle 13′ : $L \longrightarrow C_L$: OT — $o - 2u - o - 2u$.
half-cycle 14′ : $C_L \longrightarrow L$: $2o - 4u - o$.
half-cycle 15′ : $L \longrightarrow R$: OT — $2o - u - o - u - 2o - 3u - 2o$.
half-cycle 16′ : $R \longrightarrow C_R$: OT — $2u - 2o - u$.
half-cycle 17′ : $C_R \longrightarrow R$: $u - 2o - 2u$.
half-cycle 18′ : $R \longrightarrow L$: OT — $3o - 2u - 2o - 2u - 2o - 2u - o - u - o$.
half-cycle 19′ : $L \longrightarrow C_L$: OT — $o - 2u - 2o - u - o - u$.
half-cycle 20′ : $C_L \longrightarrow L$: $2o - 2u - 2o - 2u - o$.
half-cycle 21′ : $L \longrightarrow R$: OT — $2o - u - o - 2u - 3o - u - o - 2u - 2o - 2u$.
half-cycle 22′ : $R \longrightarrow C_R$: OT — $2u - 2o - 3u$.
half-cycle 23′ : $C_R \longrightarrow R$: $u - 2o - 2u - o - u$.
half-cycle 24′ : $R \longrightarrow L$: OT — $3o - 2u - o - u - 2o - u - o - u - 2o - 2u - 2o - 2u - o$.
half-cycle 25′ : $L \longrightarrow C_L$: OT — $o - 2u - 2o - 2u - o - 2u$.
half-cycle 26′ : $C_L \longrightarrow L$: $2o - 2u - 2o - 4u - o$.
half-cycle 27′ : $L \longrightarrow R$: OT — $2o - u - o - 2u - 2o - u - 2o - u - o - 3u - 2o - 2u - o - u$.
half-cycle 28′ : $R \longrightarrow C_R$: OT — $2u - 2o - 2u - 2o - u$.
half-cycle 29′ : $C_R \longrightarrow R$: $u - 2o - 2u - 2o - 2u$.
half-cycle 30′ : $R \longrightarrow L$: OT — $3o - 2u - 2o - 2u - 2o - u - 2o - 2u - 2o - 2u - 2o - 2u - o$.

half-cycle 1″ : $R_1 \longrightarrow L$: $u - o$.
half-cycle 2″ : $L \longrightarrow R_2$: OT — $o - 2u$.
half-cycle 3″ : $R_2 \longrightarrow L$: $2u - o$.
half-cycle 4″ : $L \longrightarrow R_1$: OT — $o - u - 2o$.
half-cycle 5″ : $R_1 \longrightarrow L$: $u - o - u - o$.
half-cycle 6″ : $L \longrightarrow R_2$: OT — $o - 2u - o - u$.
half-cycle 7″ : $R_2 \longrightarrow L$: $2o - 2u - o$.
half-cycle 8″ : $L \longrightarrow R_1$: OT — $o - u - 4o$.
half-cycle 9″ : $R_1 \longrightarrow L$: $u - o - u - o - u - o$.

half-cycle 10″ : $L \longrightarrow R_2$: OT — $o - 2u - o - u - o - u$.
half-cycle 11″ : $R_2 \longrightarrow L$: $4o - 2u - o$.
half-cycle 12″ : $L \longrightarrow R_1$: OT — $2o - u - 5o - u$.
half-cycle 13″ : $R_1 \longrightarrow L$: $o - u - o - u - 2o - 2u - o$.
half-cycle 14″ : $L \longrightarrow R_2$: OT — $o - 2u - o - u - 2o - 2u$.
half-cycle 15″ : $R_2 \longrightarrow L$: $4o - 4u - o$.
half-cycle 16″ : $L \longrightarrow R_1$: OT — $2o - u - 3o - 2u - 2o - u$.
half-cycle 17″ : $R_1 \longrightarrow L$: $o - u - 2o - 2u - 2o - 2u - o$.
half-cycle 18″ : $L \longrightarrow R_2$: OT — $o - 2u - 2o - 2u - 2o - 2u$.
half-cycle 19″ : $R_2 \longrightarrow L$: $2o - 2u - 2o - 4u - o$.
half-cycle 20″ : $L \longrightarrow R_1$: OT — $2o - u - o - 2u - 2o - 2u - 2o - u$.

When for half-cycle 1′ the grainside is uppermost then the uppermost surface for the half-cycles of the central knot are (G indicates grain-side and F indicates flesh-side):

G	G	F	G	G	F
1′	2′	3′	4′	5′	6′
7′	8′	9′	10′	11′	12′
13′	14′	15′	16′	17′	18′
19′	20′	21′	22′	23′	24′
25′	26′	27′	28′	29′	30′

Hence the grain-side and flesh side of the string forms a balanced pattern in the central knot, which is an important requirement of course.

When we change the leftmost and rightmost interwoven knots in Fig. 909 to those in Fig. 910, we obtain a simple hour-glass knot. It should be braided over a suitable (braided) foundation.

Its half-cycle braiding algorithms are:

half-cycle 1 : Free run.
half-cycle 2 : $i = 0$: OT — Free run.
half-cycle 3 : $i = 0$: OT — Free run.
half-cycle 4 : $i \leq 1$: OT — o.
half-cycle 5 : $i \leq 1$: OT — o.
half-cycle 6 : $i \leq 2$: OT — $o - u$.
half-cycle 7 : $i \leq 2$: OT — $o - u$.
half-cycle 8 : $i \leq 3$: OT — $o - u - o$.
half-cycle 9 : $i \leq 3$: OT — $o - u - o$.
half-cycle 10 : $i \leq 4$: OT — $o - u - o - u$.
half-cycle 11 : $i \leq 4$: OT — $o - u - o - u$.
half-cycle 12 : $i \leq 5$: OT — $o - u - o - u - o$.
half-cycle 13 : $i \leq 5$: OT — $o - u - o - u - o$.
half-cycle 14 : $i \leq 6$: OT — $o - u - o - u - o - u$.
half-cycle 15 : $i \leq 6$: OT — $o - u - o - u - o - u$.
half-cycle 16 : $i \leq 7$: OT — $o - u - o - u - o - u - o$.
half-cycle 17 : $i \leq 7$: OT — $o - u - o - u - o - u - o$.
half-cycle 18 : $i \leq 8$: OT — $o - u - o - u - o - u - o - u$.
half-cycle 19 : $i \leq 8$: OT — $o - u - o - u - o - u - o - u$.
half-cycle 20 : $i \leq 9$: OT — $o - u - o - u - o - u - o - u$.

half-cycle 1′ : $L \longrightarrow C_L$: $o - u$.
half-cycle 2′ : $C_L \longrightarrow L$: $2u - o$.

half-cycle $3'$: $L \longrightarrow R$: OT — $o - u - o$.
half-cycle $4'$: $R \longrightarrow C_R$: OT — u.
half-cycle $5'$: $C_R \longrightarrow R$: u.
half-cycle $6'$: $R \longrightarrow L$: OT — $u - o - u - o - u - o$.
half-cycle $7'$: $L \longrightarrow C_L$: OT — $o - u - o - u$.
half-cycle $8'$: $C_L \longrightarrow L$: $2o - u - o$.
half-cycle $9'$: $L \longrightarrow R$: OT — $o - u - 3o - 2u$.
half-cycle $10'$: $R \longrightarrow C_R$: OT — $3u$.
half-cycle $11'$: $C_R \longrightarrow R$: $u - o - u$.
half-cycle $12'$: $R \longrightarrow L$: OT — $2o - u - 2o - u - 2o - 2u - o$.
half-cycle $13'$: $L \longrightarrow C_L$: OT — $o - 2u - o - 2u$.
half-cycle $14'$: $C_L \longrightarrow L$: $2o - 4u - o$.
half-cycle $15'$: $L \longrightarrow R$: OT — $2o - u - o - u - 2o - 3u - 2o$.
half-cycle $16'$: $R \longrightarrow C_R$: OT — $2u - 2o - u$.
half-cycle $17'$: $C_R \longrightarrow R$: $u - 2o - 2u$.
half-cycle $18'$: $R \longrightarrow L$: OT — $3o - 2u - 2o - 2u - 2o - 2u - o - u - o$.
half-cycle $19'$: $L \longrightarrow C_L$: OT — $o - 2u - 2o - u - o - u$.
half-cycle $20'$: $C_L \longrightarrow L$: $2o - 2u - 2o - 2u - o$.
half-cycle $21'$: $L \longrightarrow R$: OT — $2o - u - o - 2u - 3o - u - o - 2u - 2o - 2u$.
half-cycle $22'$: $R \longrightarrow C_R$: OT — $2u - 2o - 3u$.
half-cycle $23'$: $C_R \longrightarrow R$: $u - 2o - 2u - o - u$.
half-cycle $24'$: $R \longrightarrow L$: OT — $3o - 2u - o - u - 2o - u - o - u - 2o - 2u - 2o - 2u - o$.
half-cycle $25'$: $L \longrightarrow C_L$: OT — $o - 2u - 2o - 2u - o - 2u$.
half-cycle $26'$: $C_L \longrightarrow L$: $2o - 2u - 2o - 4u - o$.
half-cycle $27'$: $L \longrightarrow R$: OT — $2o - u - o - 2u - 2o - u - 2o - u - o - 3u - 2o - 2u - o - u$.
half-cycle $28'$: $R \longrightarrow C_R$: OT — $2u - 2o - 2u - 2o - u$.
half-cycle $29'$: $C_R \longrightarrow R$: $u - 2o - 2u - 2o - 2u$.
half-cycle $30'$: $R \longrightarrow L$: OT — $3o - 2u - 2o - 2u - 2o - u - 2o - 2u - 2o - 2u - 2o - 2u - o$.

half-cycle $1''$: $u - o$.
half-cycle $2''$: $i = 0$: OT — $o - u$.
half-cycle $3''$: $i = 0$: OT — $u - o$.
half-cycle $4''$: $i \leq 1$: OT — $2o - u$.
half-cycle $5''$: $i \leq 1$: OT — $o - u - o$.
half-cycle $6''$: $i \leq 2$: OT — $2o - 2u$.
half-cycle $7''$: $i \leq 2$: OT — $o - 2u - o$.
half-cycle $8''$: $i \leq 3$: OT — $2o - 2u - o$.
half-cycle $9''$: $i \leq 3$: OT — $o - u - o - u - o$.
half-cycle $10''$: $i \leq 4$: OT — $2o - 2u - o - u$.
half-cycle $11''$: $i \leq 4$: OT — $o - u - o - 2u - o$.
half-cycle $12''$: $i \leq 5$: OT — $2o - 2u - o - u - o$.
half-cycle $13''$: $i \leq 5$: OT — $o - u - o - u - o - u - o$.
half-cycle $14''$: $i \leq 6$: OT — $2o - 2u - o - u - o - u$.
half-cycle $15''$: $i \leq 6$: OT — $o - u - o - u - o - 2u - o$.
half-cycle $16''$: $i \leq 7$: OT — $2o - 2u - o - u - o - u - o$.

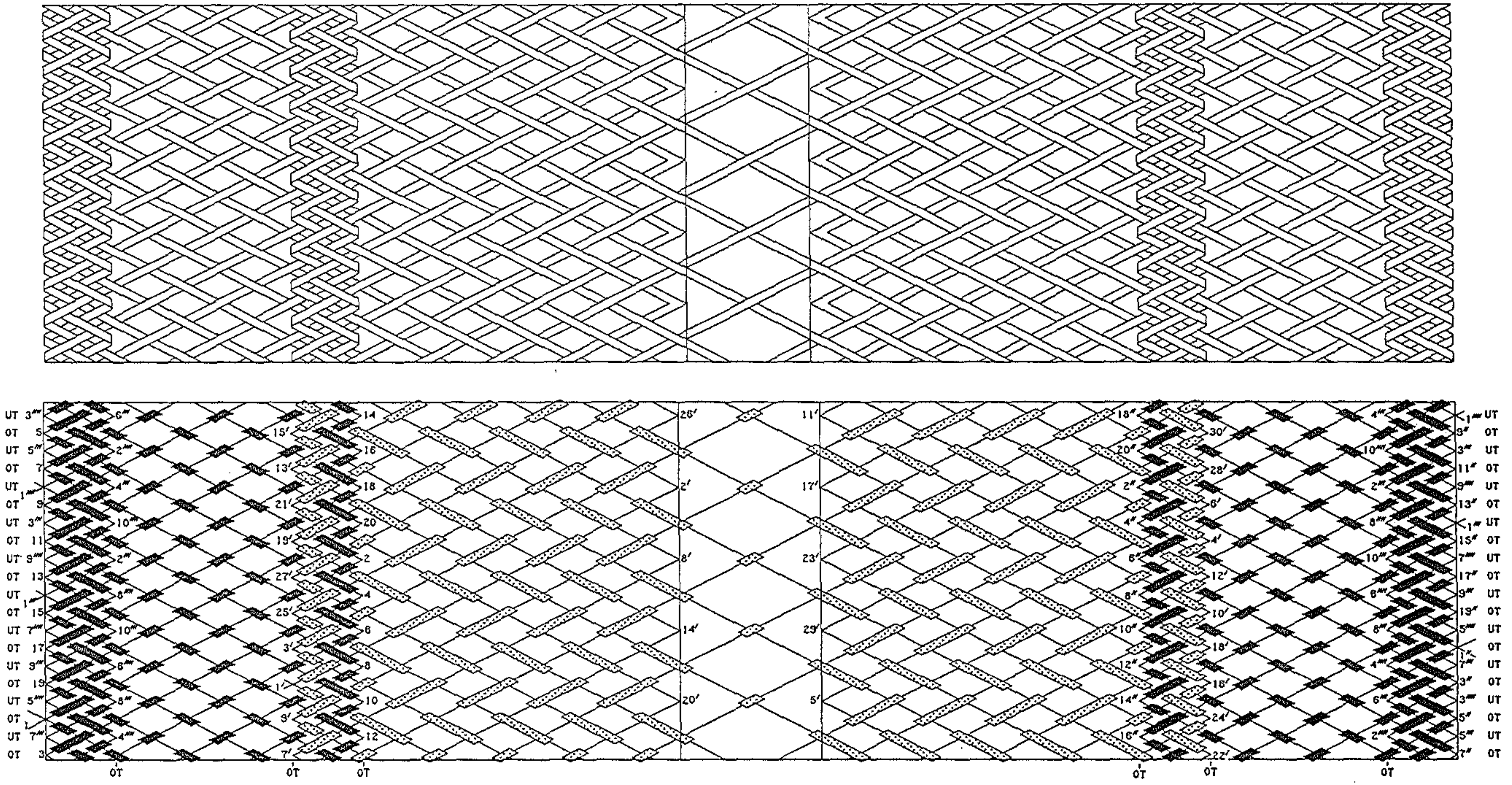

Fig. 910 — A simple Hour-glass Knot.

half-cycle 17'' : $i \leq 7$: OT — $o-u-o-u-o-u-o-u-o$.
half-cycle 18'' : $i \leq 8$: OT — $2o-2u-o-u-o-u-o-u$.
half-cycle 19'' : $i \leq 8$: OT — $o-u-o-u-o-u-o-2u-o$.
half-cycle 20'' : $i \leq 9$: OT — $2o-2u-o-u-o-u-o-u$.

---

half-cycle 1''' : $u-o$.
half-cycle 2''' : OT — $o-u$.
half-cycle 3''' : UT — $u-o$.
half-cycle 4''' : OT — $o-u$.
half-cycle 5''' : UT — $u-o$.
half-cycle 6''' : OT — $o-u$.
half-cycle 7''' : UT — $u-o$.
half-cycle 8''' : OT — $o-u$.
half-cycle 9''' : UT — $u-o$.
half-cycle 10''' : OT — $o-u$.

half-cycle 1'''' : $2u-o$.
half-cycle 2'''' : OT — $2o-u$.
half-cycle 3'''' : UT — $2u-o$.
half-cycle 4'''' : OT — $2o-u$.
half-cycle 5'''' : UT — $2u-o$.
half-cycle 6'''' : OT — $2o-u$.
half-cycle 7'''' : UT — $2u-o$.
half-cycle 8'''' : OT — $2o-u$.
half-cycle 9'''' : UT — $2u-o$.
half-cycle 10'''' : OT — $2o-u$.

THE BRAIDER'S NOTEBOOK

We mentioned on pg. 1148 that braids with interbraided bight-edges, as for example in Fig. 902, are often confused with Crocodile Ridge Braids. The Crocodile Ridge Braid as counter part to Fig. 902 is depicted in Fig. 911.

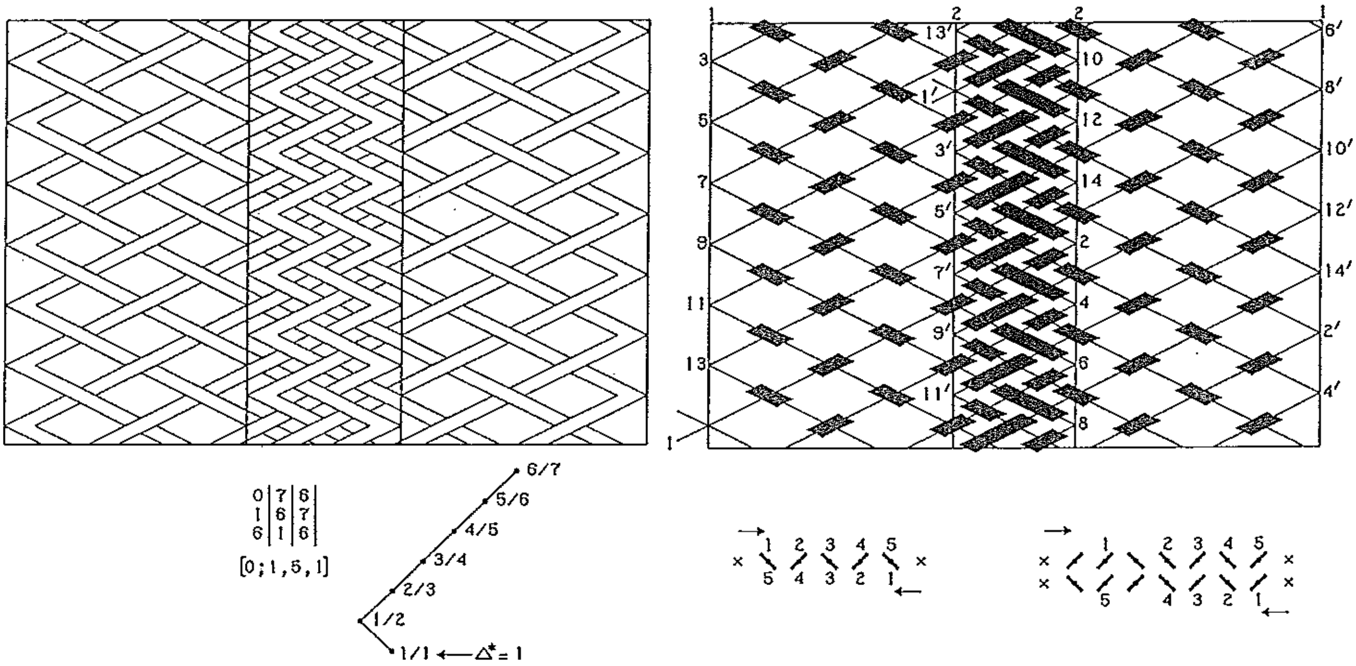

Fig. 911 — A cylindrical Crocodile Ridge Braid.

Its half-cycle braiding algorithms are:

half-cycle 1 : Free run.
half-cycle 2 : $i = 0$: Free run.
half-cycle 3 : $i = 0$: Free run.
half-cycle 4 : $i \leq 1$: o.
half-cycle 5 : $i \leq 1$: u.

half-cycle 6: $i \leq 2$: $o - u$.
half-cycle 7: $i \leq 2$: $u - o$.
half-cycle 8: $i \leq 3$: $o - u - o$.
half-cycle 9: $i \leq 3$: $u - o - u$.
half-cycle 10: $i \leq 4$: $o - u - o - u$.
half-cycle 11: $i \leq 4$: $u - o - u - o$.
half-cycle 12: $i \leq 5$: $o - u - o - u - o$.
half-cycle 13: $i \leq 5$: $u - o - u - o - u$.
half-cycle 14: $i \leq 6$: $o - u - o - u - o$.

half-cycle 1′: $o - u$.
half-cycle 2′: $i = 0$: $u - o$.
half-cycle 3′: $i = 0$: $o - u$.
half-cycle 4′: $i \leq 1$: $2u - o$.
half-cycle 5′: $i \leq 1$: $2o - u$.
half-cycle 6′: $i \leq 2$: $u - o - u - o$.
half-cycle 7′: $i \leq 2$: $2o - 2u$.
half-cycle 8′: $i \leq 3$: $u - o - 2u - o$.
half-cycle 9′: $i \leq 3$: $2o - 2u - o$.
half-cycle 10′: $i \leq 4$: $u - o - u - o - u - o$.
half-cycle 11′: $i \leq 4$: $2o - 2u - o - u$.
half-cycle 12′: $i \leq 5$: $u - o - u - o - 2u - o$.
half-cycle 13′: $i \leq 5$: $2o - 2u - o - u - o$.
half-cycle 14′: $i \leq 6$: $u - o - u - o - 2u - o$.

Hence its half-cycle braiding algorithms are those of the knot in Fig. 902 **without** the OT's.

If we interbraid in a similar way the bight-edges of two $p/b = 3/7$ under-over coded Regular Knots, then we obtain the two left diagrams in Fig. 912. This Cylindrical Crocodile Ridge Braid is a Regular Nested Cylindrical Braid ($A = 2$, $x = 4$, $y = 2$), and represents the limit case for this type of Cylindrical Crocodile Ridge Braid as far as the parts p are concerned.

Although its half-cycle braiding algorithms are

half-cycle 1:	Free run.	half-cycle 1′:	$o - u$.
half-cycle 2: $i = 0$	: Free run.	half-cycle 2′: $i = 0$:	$u - o$.
half-cycle 3: $i = 0$	: Free run.	half-cycle 3′: $i = 0$:	$o - u$.
half-cycle 4: $i \leq 1$	: Free run.	half-cycle 4′: $i \leq 1$:	$u - o$.
half-cycle 5: $i \leq 1$	: Free run.	half-cycle 5′: $i \leq 1$:	$o - u$.
half-cycle 6: $i \leq 2$	: o.	half-cycle 6′: $i \leq 2$:	$o - u - o$.
half-cycle 7: $i \leq 2$	: o.	half-cycle 7′: $i \leq 2$:	$2o - u$.
half-cycle 8: $i \leq 3$	: o.	half-cycle 8′: $i \leq 3$:	$o - u - o$.
half-cycle 9: $i \leq 3$	: o.	half-cycle 9′: $i \leq 3$:	$2o - u$.
half-cycle 10: $i \leq 4$	: $o - u$.	half-cycle 10′: $i \leq 4$:	$o - 2u - o$.
half-cycle 11: $i \leq 4$	: $o - u$.	half-cycle 11′: $i \leq 4$:	$2o - 2u$.
half-cycle 12: $i \leq 5$	: $o - u$.	half-cycle 12′: $i \leq 5$:	$o - 2u - o$.
half-cycle 13: $i \leq 5$	: $o - u$.	half-cycle 13′: $i \leq 5$:	$2o - 2u$.
half-cycle 14: $i \leq 6$	: $o - u$.	half-cycle 14′: $i \leq 6$:	$o - 2u - o$.

we would braid in practice the left-hand *over-under* coded Regular Knot (the $p/b = 3/7$ *over-under* coded Regular Knot with the half-cycles 1-14) via the $p/b = 3/4$ *over-under* coded Regular Knot from the $p/b = 3/1$ *over-under* coded Regular Knot (see *The Braider*, Appendix 1996).

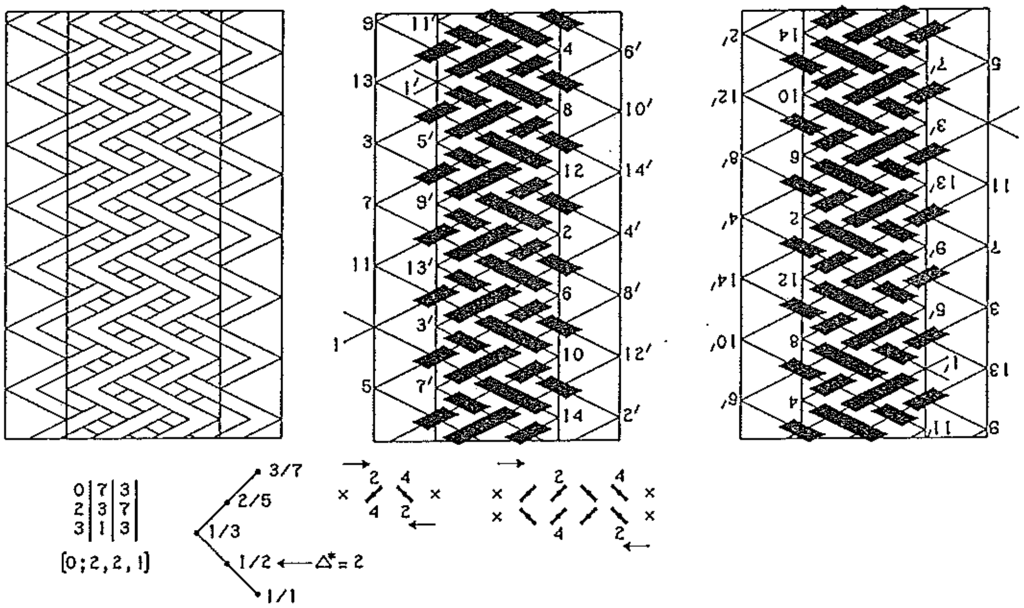

Fig. 912 — Cylindrical Crocodile Ridge Braid as Regular Nested Cylindrical Braid.

When we turn this braid through 180° we obtain its rightmost diagram in Fig. 912. This depicts the braid in the *Encyclopedia of Rawhide and Leather Braiding* by Bruce Grant, pp. 230-231, fig. 6.[†]

Note that we have met this knot in its imitation duplex form as the Double Twin Scallop Barcus Knot in Appendix 2000, pp. *vii-xii*.

A Sliding Lanyard Knot

In a lanyard we like to be able to adjust the necklace loop. This can be achieved by providing one end of the round braid used for the lanyard with a knot through which the other end of the lanyard round braid can slide. Fig. 913 depicts such a sliding knot for a four string round braid.

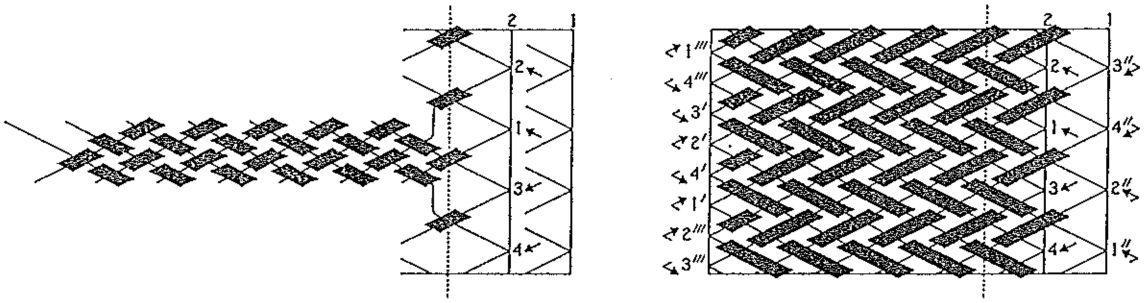

Fig. 913 — A Sliding Knot for a four-string round braid.

[†] Note that fig. 6 on pg. 231 in Bruce Grant's book does not show OT's on the interwoven bight-boundaries; it thus depicts a Crocodile Ridge Braid. Hence note that the figs. 3-5 should also not have OT's (and neither UT's of course).

When 2.2 mm. wide string of 0.8 mm. thickness is used, the four-string round braid will be 4 mm. in diameter. The Sliding Knot will have a slightly oval cross section of approximately 11 by 10 mm. and will be approximately 17 mm. long.

After forming the loop in the four-string round braid, place its Sliding Knot end on top of the other loop-end and finish the Sliding Knot end as indicated in the left-hand diagram of Fig. 913 (the dotted line encircles the four-string round braid of the loop which was placed under its Sliding Knot end). Tie a Contrictor Knot over the four crossings on the dotted line in the left-hand diagram (these four crossings belong to the knot in the right-hand diagram of Fig. 913 at the position of the dotted line in that diagram).

The half-cycle braiding algorithms for the sliding knot (the knot depicted by the right-hand diagram in Fig. 913) are:

half-cycle 1 left of the dotted line : Free run.
half-cycle 2 left of the dotted line : Free run.
half-cycle 3 left of the dotted line : $u - o$.
half-cycle 4 left of the dotted line : $u - o$.

---

half-cycle $1'$: $o - u - o$.
half-cycle $2'$: $o - u - o$.
half-cycle $3'$: $2o - 2u - 2o - u$.
half-cycle $4'$: $2o - 2u - o$.

---

half-cycle $1''$: $u - 2o - 2u - o$.
half-cycle $2''$: $o - u - 2o - u$.
half-cycle $3''$: $2o - u - o - 2u - 2o - u$.
half-cycle $4''$: $2o - u - 2o - 2u - o - u$.

Remove the Constrictor Knot and any other temporary fixing arrangements that may have been used.

---

half-cycle $1'''$: $2u - 2o - u - o - 2u$.
half-cycle $2'''$: $o - 2u - o - u - 2o - 2u$.
half-cycle $3'''$: $2u - 2o - 2u - 2o - 2u$.
half-cycle $4'''$: $2u - 2o - 2u - 2o - 2u$.

In this sliding knot $x = 11$, which is for practical applications the minimum value. A longer knot can be obtained by increasing the x-value by a multiple of 4.

A good colour-pattern for the sliding knot in Fig. 913 can be created by using one colour for the strings 1 & 4 and another colour for the strings 2 & 3. The colour-pattern thus obtained is shown in Fig. 914.

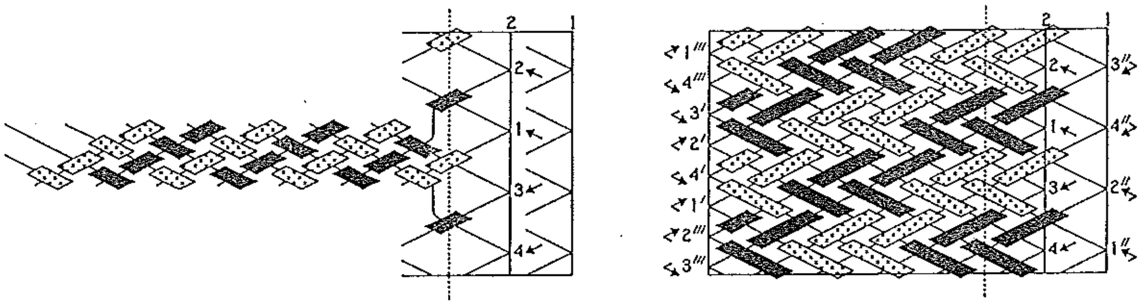

Fig. 914 — A good colour pattern for the knot in Fig. 913.

THE BRAIDER

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Braid Design 1178

A quarterly publication
for
the braiding artisan

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Solution to the Question in Issue No. 49

Question on pg. 1157.

In Issue No. 33, pg. 755, we saw that for the Asymmetric Regular Nested Cylindrical Braids we obtained for a general left and right cycle the formulae:

$$l_{i+1} = |l_i + 2A_r + x - 2(l_i + r_i)|_{A_l}\,.$$
$$r_{i+1} = |r_i + 2A_l + x - 2(r_i + l_{i+1})|_{A_r}\,.$$

Fig. 915 — A general left and right cycle associated with the Asymmetric Regular Nested Cylindrical Braids.

Furthermore we found that the following formulae are associated with these braids:

$$B_l^* = \text{number of periods at left bight-edge}\,.$$
$$B_r^* = \text{number of periods at right bight-edge}\,.$$
$$B_{total} = A_l B_l^* = A_r B_r^* = A^{**}B^{**}\,.$$
$$d = \text{g.c.d.}(A_l\,,\, A_r)\,.$$
$$A^{**} = \frac{B_{total}}{B^{**}} = \frac{A_l \cdot A_r}{d}\,.$$
$$B^{**} = \frac{B_{total} \cdot d}{A_l \cdot A_r} = \frac{B_l^* \cdot d}{A_r} = \frac{B_r^* \cdot d}{A_l}\,.$$
$$\alpha = \text{number of bights in first-return string-run}\,.$$
$$P_{component} = \frac{\alpha \cdot x + 2\alpha(A_l + A_r) - 2\sum(l_i + r_i)}{A^{**}}\,.$$
$$P_{total} = \sum P_{component} = A_l + A_r + x - 2\,.$$

$$\left.\begin{array}{r}\text{number of}\\ \text{components}\end{array}\right\} = \text{number of first-return string-runs}\,.$$

$$\left.\begin{array}{r}\text{number of}\\ \text{sub-components}\\ \text{in a component}\end{array}\right\} = \text{g.c.d.}(P_{component}\,, B^{**})\,.$$

$$\left.\begin{array}{r}\text{total number of}\\ \text{essential strings}\end{array}\right\} = \sum \text{sub-components}\,.$$

When $A_l = 1$, the left bight-edge contains only one bight-boundary and hence these formulae transform into:

$$l_{i+1} = |1 + 2A_r + x - 2(1 + r_i)|_1 = 1\,.$$
$$r_{i+1} = |r_i + 2 + x - 2(r_i + 1)|_{A_r} = |x - r_i|_{A_r}\,.$$

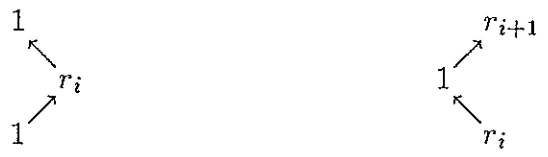


Fig. 916 — A general left and right cycle associated with the $A_l = 1$ Asymmetric Regular Nested Cylindrical Braids.

$$B_l^* = B_{total} = \text{number of periods at left bight-edge}\,.$$

$$B_r^* = \text{number of periods at right bight-edge}\,.$$

$$B_{total} = B_l^* = A_r B_r^* = A^{**}B^{**}\,.$$

$$d = \text{g.c.d.}(1\,,\,A_r) = 1\,.$$

$$A^{**} = \frac{B_{total}}{B^{**}} = \frac{A_r}{1} = A_r\,.$$

$$B^{**} = \frac{B_{total}\cdot 1}{1\cdot A_r} = \frac{B_l^*}{A_r} = B_r^*\,.$$

$$\alpha = \text{number of bights in first-return string-run}\,.$$

$$P_{component} = P_c = \frac{\alpha\cdot x + 2\alpha(1+A_r) - 2\sum(1+r_i)}{A_r}\,.$$

$$P_{total} = \sum P_{component} = A_r + x - 1\,.$$

$$\left.\begin{array}{r}\text{number of}\\ \text{components}\end{array}\right\} = \text{number of first-return string-runs}\,.$$

$$\left.\begin{array}{r}\text{number of}\\ \text{sub-components}\\ \text{in a component}\end{array}\right\} = \text{g.c.d.}(P_{component}\,,B_r^*)\,.$$

$$\left.\begin{array}{r}\text{total number of}\\ \text{essential strings}\end{array}\right\} = \sum \text{sub-components}\,.$$

Let r_i be k, then the associated first-return string-run becomes:

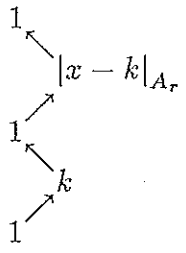
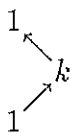


Fig. 917 — A general left and right cycle associated with the $A_l = 1$ Asymmetric Regular Nested Cylindrical Braids.

This first-return string-run reduces to



when $|x-k|_{A_r} = k$, hence when $2k = |x|_{A_r} = \mathit{even}$ and/or $2k = |x|_{A_r} + A_r = \mathit{even}$. Since $A_r \geq 2$, we require for the minimum number of first-return string-runs (the minimum number of components) that such first-return string-runs with $\alpha = 1$ don't exist (hence when $|x-k|_{A_r} \neq k$, that is when $|x|_{A_r} = \mathit{odd}$ and $|x|_{A_r} + A_r = \mathit{odd}$); hence we require $x = \mathit{odd}$ with $A_r = \mathit{even}$. Then $P_c = \frac{2x-2k-2|x-k|_{A_r}}{A_r} + 4$.

The values for k and P_c, when $|x-k|_{A_r} = k$, are:

$$\begin{array}{rl}
x = \mathit{odd},\ A_r = \mathit{odd}: & |x|_{A_r} = 0;\ 2k = 2A_r \rightarrow k = A_r;\ P_c = \frac{x}{A_r}. \\
 & |x|_{A_r} = \mathit{odd};\ 2k = |x|_{A_r} + A_r \rightarrow k = \frac{|x|_{A_r}+A_r}{2};\ P_c = \frac{x-|x|_{A_r}}{A_r} + 1. \\
 & |x|_{A_r} = \mathit{even};\ 2k = |x|_{A_r} \rightarrow k = \frac{|x|_{A_r}}{2};\ P_c = \frac{x-|x|_{A_r}}{A_r} + 2. \\
x = \mathit{odd},\ A_r = \mathit{even}: & |x|_{A_r} = \mathit{odd};\ \text{No solution for } k. \\
x = \mathit{even},\ A_r = \mathit{odd}: & |x|_{A_r} = 0;\ 2k = 2A_r \rightarrow k = A_r;\ P_c = \frac{x}{A_r}. \\
 & |x|_{A_r} = \mathit{odd};\ 2k = |x|_{A_r} + A_r \rightarrow k = \frac{|x|_{A_r}+A_r}{2};\ P_c = \frac{x-|x|_{A_r}}{A_r} + 1. \\
 & |x|_{A_r} = \mathit{even};\ 2k = |x|_{A_r} \rightarrow k = \frac{|x|_{A_r}}{2};\ P_c = \frac{x-|x|_{A_r}}{A_r} + 2. \\
x = \mathit{even},\ A_r = \mathit{even}: & |x|_{A_r} = 0;\ 2k = A_r \rightarrow k = \frac{A_r}{2};\ P_c = \frac{x}{A_r} + 1. \\
 & \qquad 2k = 2A_r \rightarrow k = A_r;\ P_c = \frac{x}{A_r} \\
 & |x|_{A_r} = \mathit{even};\ 2k = |x|_{A_r} \rightarrow k = \frac{|x|_{A_r}}{2};\ P_c = \frac{x-|x|_{A_r}}{A_r} + 2. \\
 & \qquad 2k = |x|_{A_r} + A_r \rightarrow k = \frac{|x|_{A_r}+A_r}{2};\ P_c = \frac{x-|x|_{A_r}}{A_r} + 1.
\end{array}$$

We require the minimum number of essential strings when $|x-k|_{A_r} \neq k$, hence when $x = \mathit{odd}$ with $A_r = \mathit{even}$ and g.c.d.$(P_c, B_r^*) = 1$. This minimum number of essential strings is then $\frac{A_r}{2}$ since $\alpha = 2$ for each first-return string-run.

A Braiding Project — Key-hanger No. 3

The braid forming the eye around the thimble of 25 mm. is a 4-cord under-over Round Braid as shown in Fig. 919, made at the centre of the cord lengths (cords approximately 50 cm. in length). This braid is put tightly around the thimble with both 'ends' being secured with a Double Constrictor Knot[†] immediately below the thimble.

Immediately below this constrictor knot start braiding the stem. The braid of the stem consists of a sequence of either alternating right Crown Knots or alternating left Crown Knots, one on top the other as shown in Figs. 920, 921, 922.[‡] Two opposing parallel strings in a Crown Knot have the colour A, while the other two opposing strings in the same Crown Knot have the colour B. Hence in the first two Crown Knots, colour X is colour V is colour A while colour Y is colour W is colour B; in which case in the sequence of Crown Knots, strings X & V have the same colour and strings Y & W have the same colour, while strings X & W differ in colour and strings Y & V differ in colour. Alternatively, in the first two Crown Knots, colour X is colour W is colour

---

[†] See *The Braider*, Issue No. 47, pg. 1100, Fig. 845.

[‡] For the sequence of alternating right Crown Knots, the braid of the stem is *Ashley #2936*.

A while colour *Y* is colour *V* is colour *B*; in which case in the sequence of Crown Knots, strings *X* & *W* have the same colour and strings *Y* & *V* have the same colour, while strings *X* & *V* differ in colour and strings *Y* & *W* differ in colour.

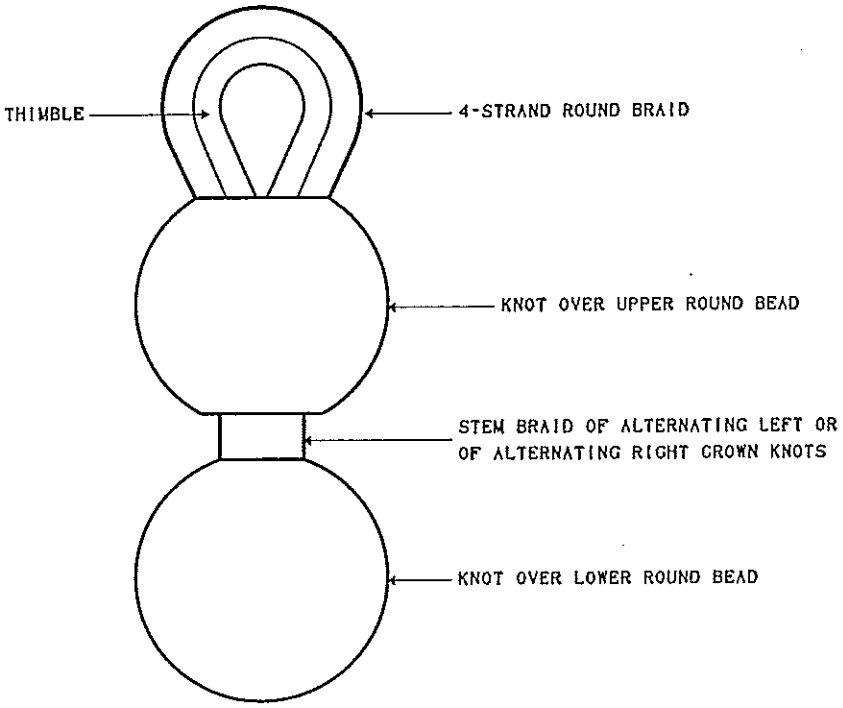

THIMBLE
4-STRAND ROUND BRAID
KNOT OVER UPPER ROUND BEAD
STEM BRAID OF ALTERNATING LEFT OR OF ALTERNATING RIGHT CROWN KNOTS
KNOT OVER LOWER ROUND BEAD

Fig. 918 — Key-hanger No. 3. Cord diameter 2 mm.

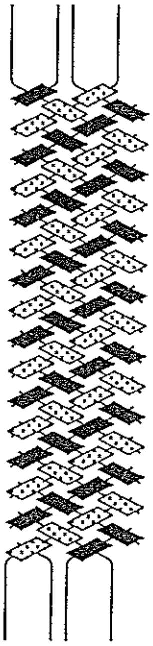


Fig. 919 — The 4-cord under-over Round Braid.

Over the stem-braid we push a 24 mm. round bead whose hole we have enlarged to obtain a tight fit, and through which we have drilled diametrically a small hole through which a small brass nail will fit tightly. This round bead is pushed up to the point of the thimble and secured in place by means of a small brass nail through the diametrically drilled hole in the bead. The ends of the small brass nail are filed flush with the bead.

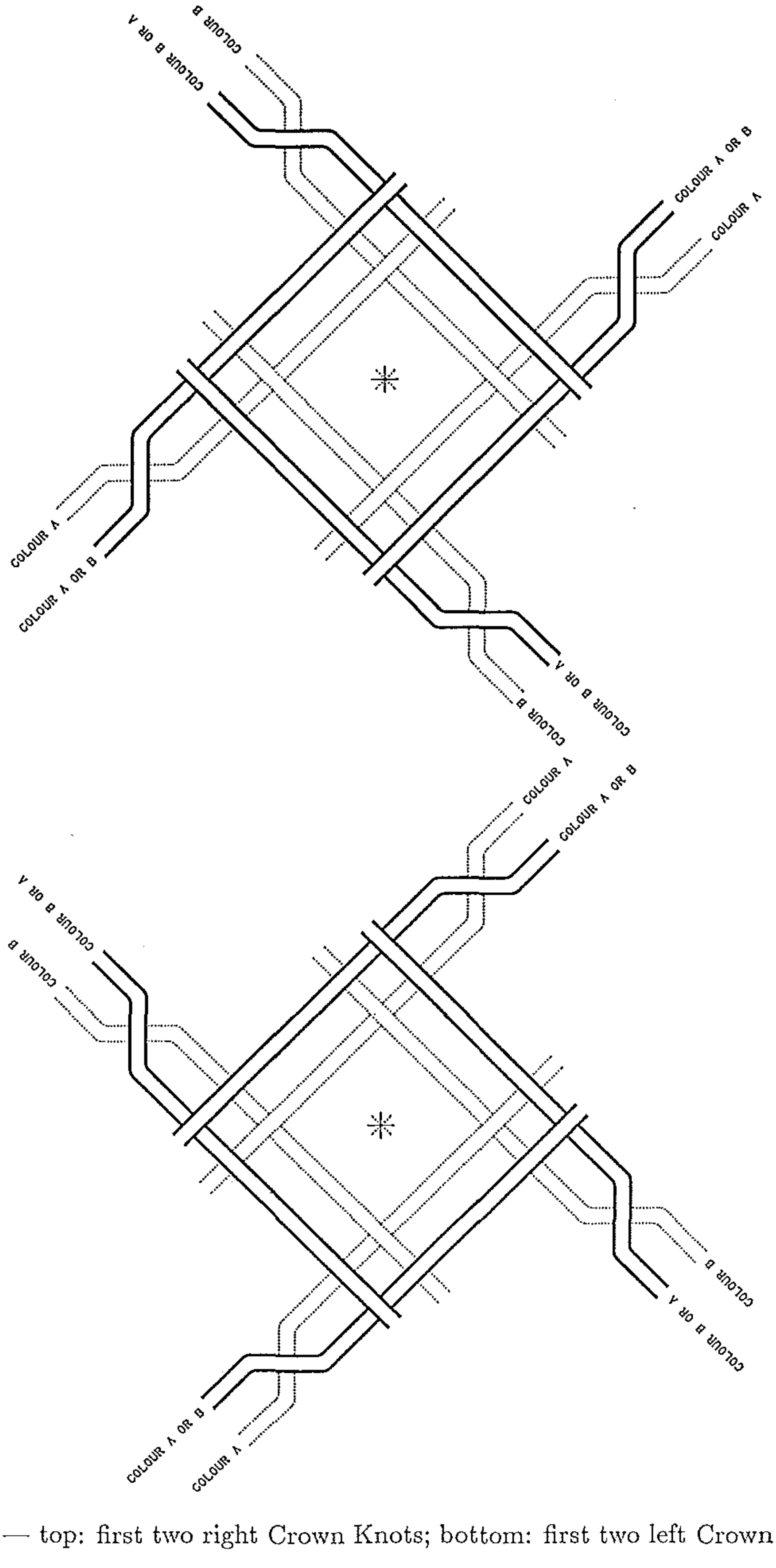


Fig. 920 — top: first two right Crown Knots; bottom: first two left Crown Knots.

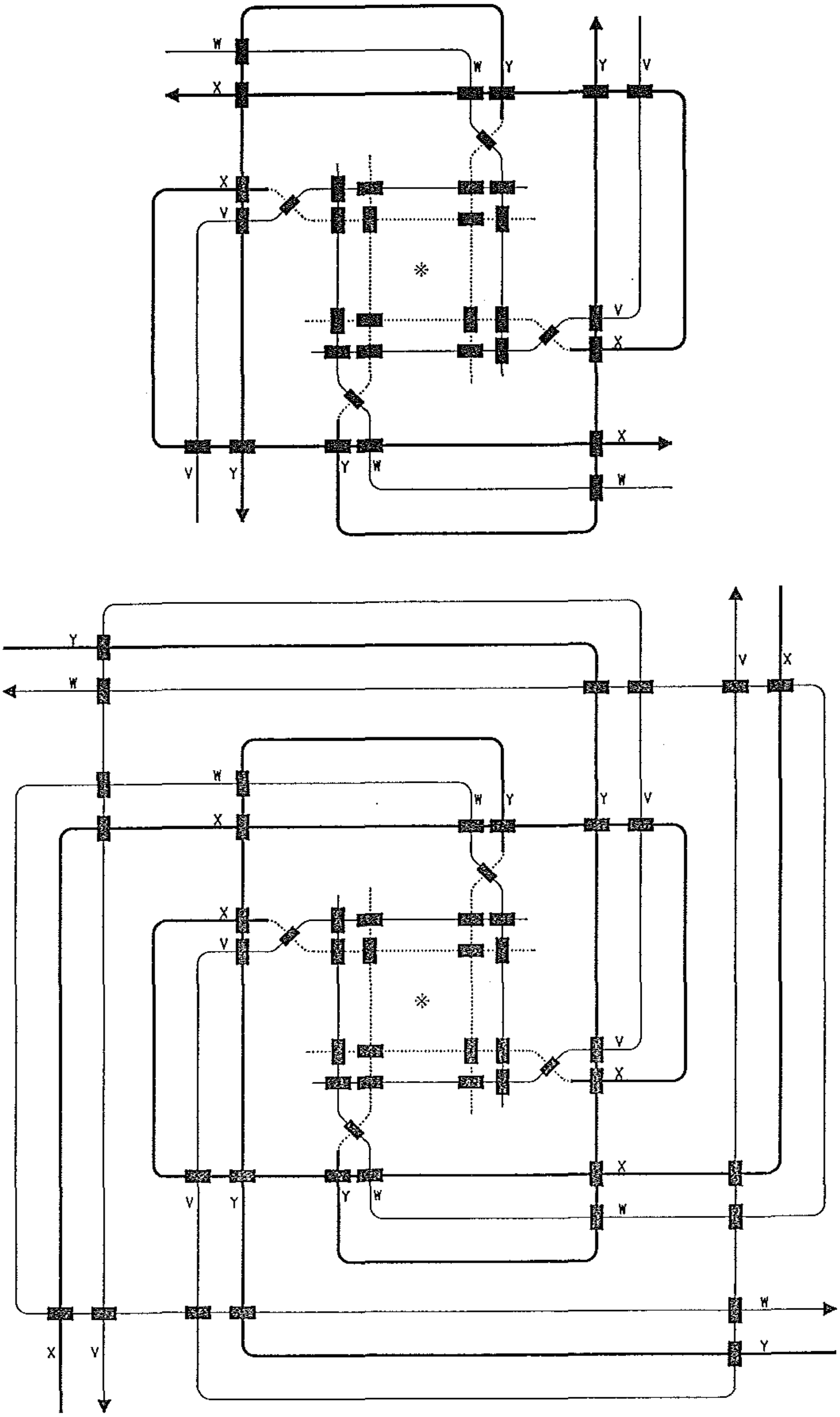


Fig. 921 — Braiding sequence of alternating right Crown Knots.

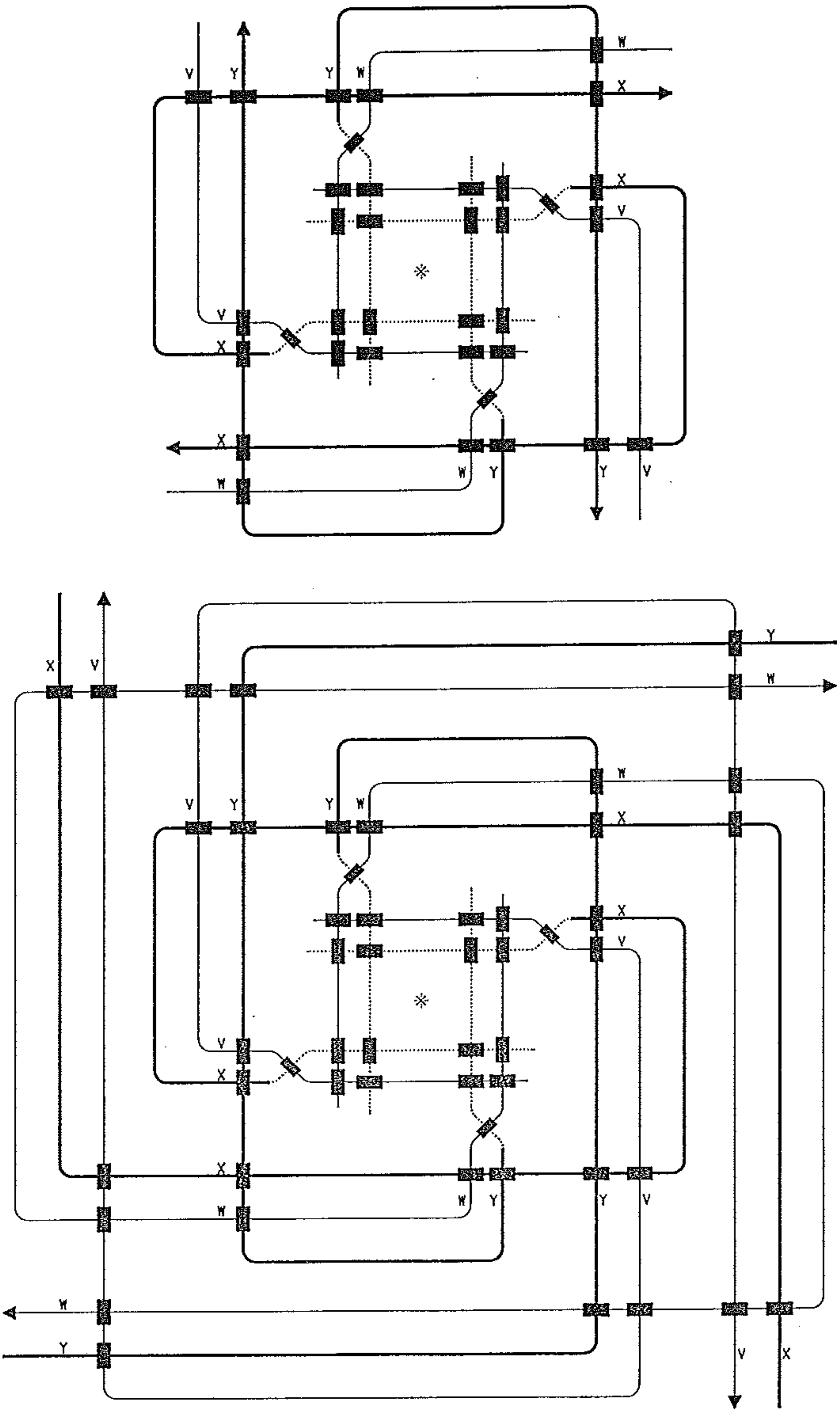


Fig. 922 — Braiding sequence of alternating left Crown Knots.

The stem braid obtained from the sequence of alternating right Crown Knots displays four sets of two adjacent left helixes; the four sets alternate in colour. The stem braid obtained from the sequence of alternating left Crown Knots displays four sets of two adjacent right helixes; the four sets alternate in colour.

The nominal grid-diagram of the knot over the round bead immediately below the thimble is depicted in Fig. 923 (left bight-edge towards thimble).

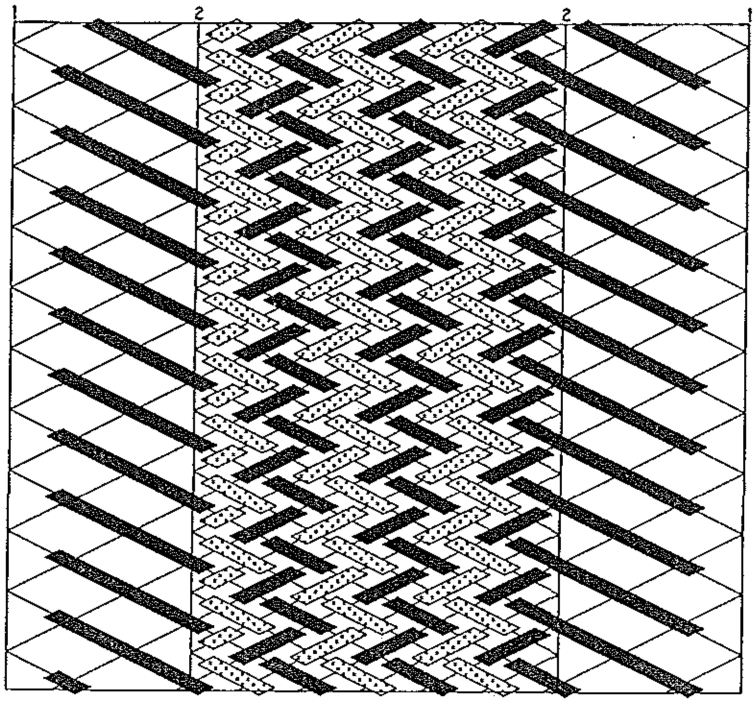


Fig. 923 — Nominal grid-diagram of the knot over round bead adjacent to thimble.

The string-run specification of this Regular Nested Knot is (6/12/6){12/12}22. Fig. 924 depicts one of the ways in which this knot may be braided. Note that this knot is an interbraid of a $p/b = 6/11$ under-over coded Regular Knot with a $p/b = 12/11$ column-coded Regular Knot.

First, we braid the column-coded Regular Knot between the bight-boundaries L_1 and R_1 as depicted in Fig. 924. Its half-cycle braiding algorithms are:

half-cycle 1 : $L_1 \longrightarrow R_1$: Free run.
half-cycle 2 : $i = 0$; $R_1 \longrightarrow L_1$: $(s)o$.
half-cycle 3 : $i = 0$; $L_1 \longrightarrow R_1$: u.
half-cycle 4 : $i \leq 1$; $R_1 \longrightarrow L_1$: $(s, 1)2o$.
half-cycle 5 : $i \leq 1$; $L_1 \longrightarrow R_1$: $2u$.
half-cycle 6 : $i \leq 2$; $R_1 \longrightarrow L_1$: $(s, 2)3o$.
half-cycle 7 : $i \leq 2$; $L_1 \longrightarrow R_1$: $3u$.
half-cycle 8 : $i \leq 3$; $R_1 \longrightarrow L_1$: $(s)u - 3o$.
half-cycle 9 : $i \leq 3$; $L_1 \longrightarrow R_1$: $o - 3u$.
half-cycle 10 : $i \leq 4$; $R_1 \longrightarrow L_1$: $(s)o - u - 3o$.
half-cycle 11 : $i \leq 4$; $L_1 \longrightarrow R_1$: $u - o - 3u$.
half-cycle 12 : $i \leq 5$; $R_1 \longrightarrow L_1$: $(s)u - o - u - 3o$.
half-cycle 13 : $i \leq 5$; $L_1 \longrightarrow R_1$: $o - u - o - 3u$.
half-cycle 14 : $i \leq 6$; $R_1 \longrightarrow L_1$: $(s)o - u - o - u - 3o$.
half-cycle 15 : $i \leq 6$; $L_1 \longrightarrow R_1$: $u - o - u - o - 3u$.

half-cycle 16 : $i \le 7$; $R_1 \longrightarrow L_1$: $(s)u - o - u - o - u - 3o$.
half-cycle 17 : $i \le 7$; $L_1 \longrightarrow R_1$: $o - u - o - u - o - 3u$.
half-cycle 18 : $i \le 8$; $R_1 \longrightarrow L_1$: $(s)o - u - o - u - o - u - 3o$.
half-cycle 19 : $i \le 8$; $L_1 \longrightarrow R_1$: $u - o - u - o - u - o - 3u$.
half-cycle 20 : $i \le 9$; $R_1 \longrightarrow L_1$: $(s,1)2o - u - o - u - o - u - 3o$.
half-cycle 21 : $i \le 9$; $L_1 \longrightarrow R_1$: $2u - o - u - o - u - o - 3u$.
half-cycle 22 : $i \le 10$; $R_1 \longrightarrow L_1$: $(s,2)3o - u - o - u - o - u - 3o$.

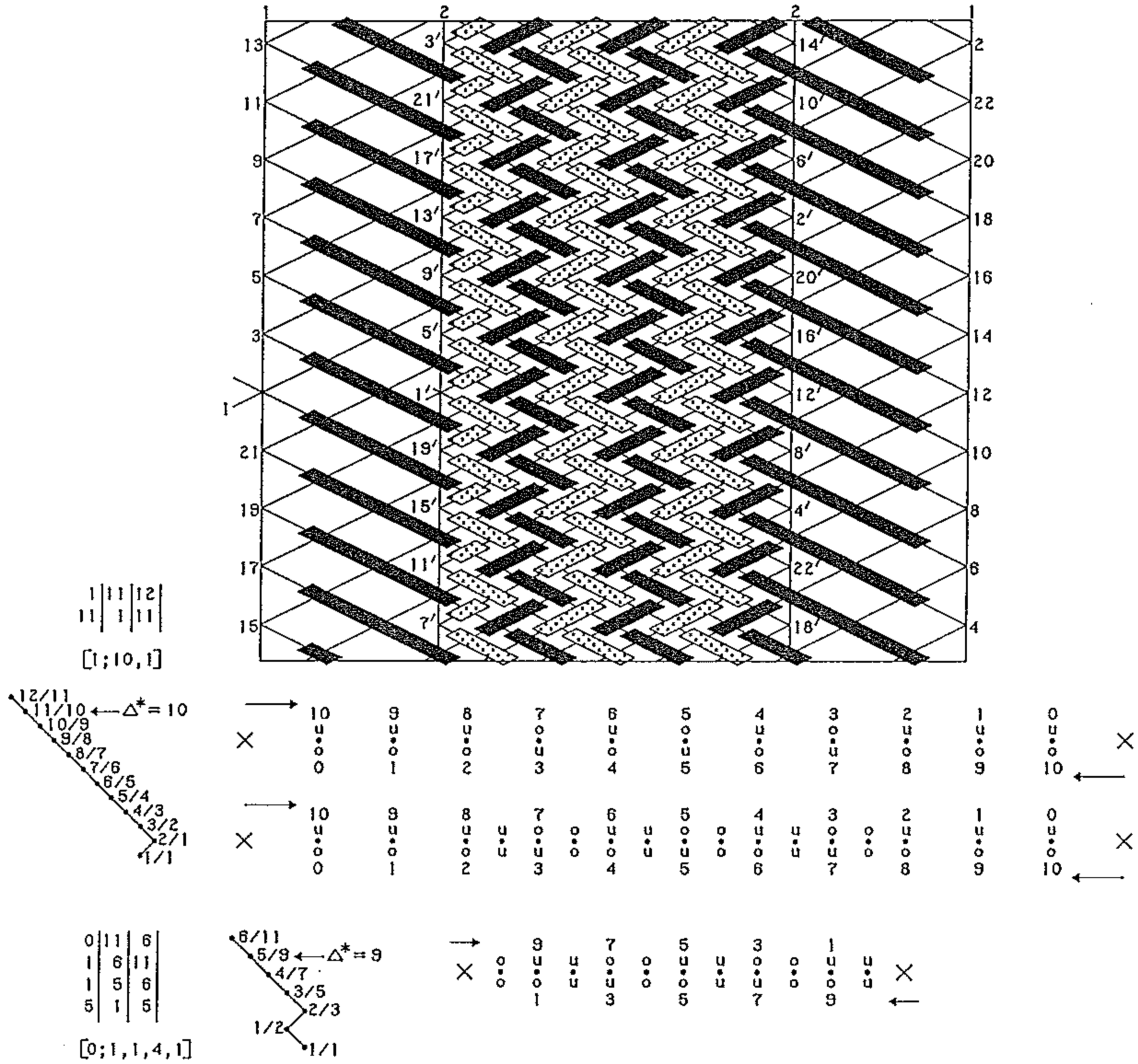


Fig. 924 — Grid-diagram of the knot over round bead adjacent to thimble.

Next we braid the half-cycles 1′ to 21′ of the Regular Knot between the bight-boundaries L_2 and R_2 as depicted in Fig. 924. Its half-cycle braiding algorithms are:

half-cycle 1′ : $L_2 \longrightarrow R_2$: $o - u - o - u - o - u$.
half-cycle 2′ : $i = 0$; $R_2 \longrightarrow L_2$: $u - o - u - o - u - o$.
half-cycle 3′ : $i = 0$; $L_2 \longrightarrow R_2$: $o - u - o - u - o - u$.
half-cycle 4′ : $i \le 1$; $R_2 \longrightarrow L_2$: $u - o - u - o - u - (s,1)2o$.
half-cycle 5′ : $i \le 1$; $L_2 \longrightarrow R_2$: $o - u - o - u - o - 2u$.
half-cycle 6′ : $i \le 2$; $R_2 \longrightarrow L_2$: $u - o - u - o - u - 2o$.
half-cycle 7′ : $i \le 2$; $L_2 \longrightarrow R_2$: $o - u - o - u - o - 2u$.
half-cycle 8′ : $i \le 3$; $R_2 \longrightarrow L_2$: $u - o - u - o - (s,1)2u - 2o$.

half-cycle $9'$: $i \leq 3$; $L_2 \longrightarrow R_2$: $o - u - o - u - 2o - 2u$.
half-cycle $10'$: $i \leq 4$; $R_2 \longrightarrow L_2$: $u - o - u - o - 2u - 2o$.
half-cycle $11'$: $i \leq 4$; $L_2 \longrightarrow R_2$: $o - u - o - u - 2o - 2u$.
half-cycle $12'$: $i \leq 5$; $R_2 \longrightarrow L_2$: $u - o - u - (s,1)2o - 2u - 2o$.
half-cycle $13'$: $i \leq 5$; $L_2 \longrightarrow R_2$: $o - u - o - 2u - 2o - 2u$.
half-cycle $14'$: $i \leq 6$; $R_2 \longrightarrow L_2$: $u - o - u - 2o - 2u - 2o$.
half-cycle $15'$: $i \leq 6$; $L_2 \longrightarrow R_2$: $o - u - o - 2u - 2o - 2u$.
half-cycle $16'$: $i \leq 7$; $R_2 \longrightarrow L_2$: $u - o - (s,1)2u - 2o - 2u - 2o$.
half-cycle $17'$: $i \leq 7$; $L_2 \longrightarrow R_2$: $o - u - 2o - 2u - 2o - 2u$.
half-cycle $18'$: $i \leq 8$; $R_2 \longrightarrow L_2$: $u - o - 2u - 2o - 2u - 2o$.
half-cycle $19'$: $i \leq 8$; $L_2 \longrightarrow R_2$: $o - u - 2o - 2u - 2o - 2u$.
half-cycle $20'$: $i \leq 9$; $R_2 \longrightarrow L_2$: $u - (s,1)2o - 2u - 2o - 2u - 2o$.
half-cycle $21'$: $i \leq 9$; $L_2 \longrightarrow R_2$: $o - 2u - 2o - 2u - 2o - 2u$.

Then we braid half-cycle $22'$ as: $u - 2o - 8u$, and the Standing-End of half-cycle $1'$ as $2o - 2u - 2o - 5u$ from upper L_2 to lower R.
Next, retract the end of half-cycle 22 over seven crossings and replace these by $4u - 3o$. Then braid the Standing-End of half-cycle 1 as $3o - 2u - 2o - 10u$ from upper L_1 to lower R.

The nominal grid-diagram of the knot over the round bead at the end of the stem is depicted in Fig. 925 (left bight-edge towards thimble).

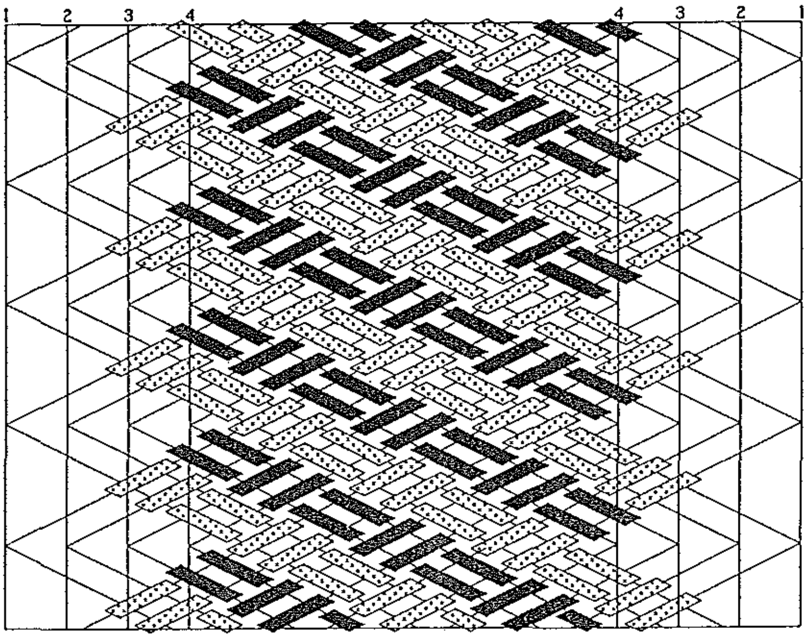
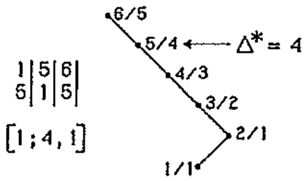
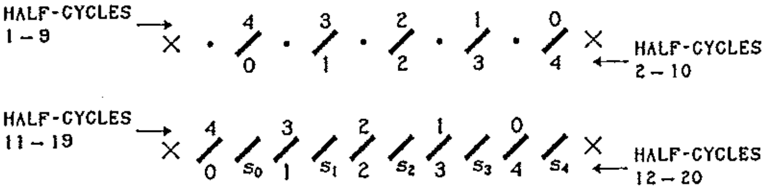


Fig. 925 — Nominal grid-diagram of the knot over round bead at end of stem.

This Regular Nested Knot with string-run specification (222/14/222){1432/2341}20, is an interbraid of a doubled $p/b = 6/5$ Matthew Walker Knot (a Regular Knot in which all columns have an identical coding) with another doubled $p/b = 4/5$ Matthew Walker Knot (same coding orientation in both Matthew Walker Knots). One of the ways in which this knot may be braided is depicted in Fig. 926.

First, we braid the doubled $p/b = 6/5$ Matthew Walker Knot between the bight-boundaries L_1 and L_2 on the left bight-edge and the bight-boundaries R_1 and R_2 on the right bight-edge as depicted in Fig. 926. Its associated two half-cycle algorithm diagrams are:





From these algorithm diagrams we read the following half-cycle braiding algorithms:

half-cycle 1 : $L_2 \longrightarrow R_1$: Free run.
half-cycle 2 : $i = 0$; $R_1 \longrightarrow L_2$: $(s)u$.
half-cycle 3 : $i = 0$; $L_2 \longrightarrow R_1$: o .
half-cycle 4 : $i \leq 1$; $R_1 \longrightarrow L_2$: $(s,1)2u$.
half-cycle 5 : $i \leq 1$; $L_2 \longrightarrow R_1$: $2o$.
half-cycle 6 : $i \leq 2$; $R_1 \longrightarrow L_2$: $(s,2)3u$.
half-cycle 7 : $i \leq 2$; $L_2 \longrightarrow R_1$: $3o$.
half-cycle 8 : $i \leq 3$; $R_1 \longrightarrow L_2$: $(s,3)4u$.
half-cycle 9 : $i \leq 3$; $L_2 \longrightarrow R_1$: $4o$.
half-cycle 10 : $i \leq 4$; $R_1 \longrightarrow L_1$: $(s,4)5u$.
half-cycle 11 : $L_1 \longrightarrow R_2$: $5o$.
half-cycle 12 : $i = 0$; $R_2 \longrightarrow L_1$: $(4,s,1)6u$.
half-cycle 13 : $i = 0$; $L_1 \longrightarrow R_2$: $6o$.
half-cycle 14 : $i \leq 1$; $R_2 \longrightarrow L_1$: $(3,s,3)7u$.
half-cycle 15 : $i \leq 1$; $L_1 \longrightarrow R_2$: $7o$.
half-cycle 16 : $i \leq 2$; $R_2 \longrightarrow L_1$: $(2,s,5)8u$.
half-cycle 17 : $i \leq 2$; $L_1 \longrightarrow R_2$: $8o$.
half-cycle 18 : $i \leq 3$; $R_2 \longrightarrow L_1$: $(1,s,7)9u$.
half-cycle 19 : $i \leq 3$; $L_1 \longrightarrow R_2$: $9o$.
half-cycle 20 : $i \leq 4$; $R_2 \longrightarrow L$: $(s,9)10u$.

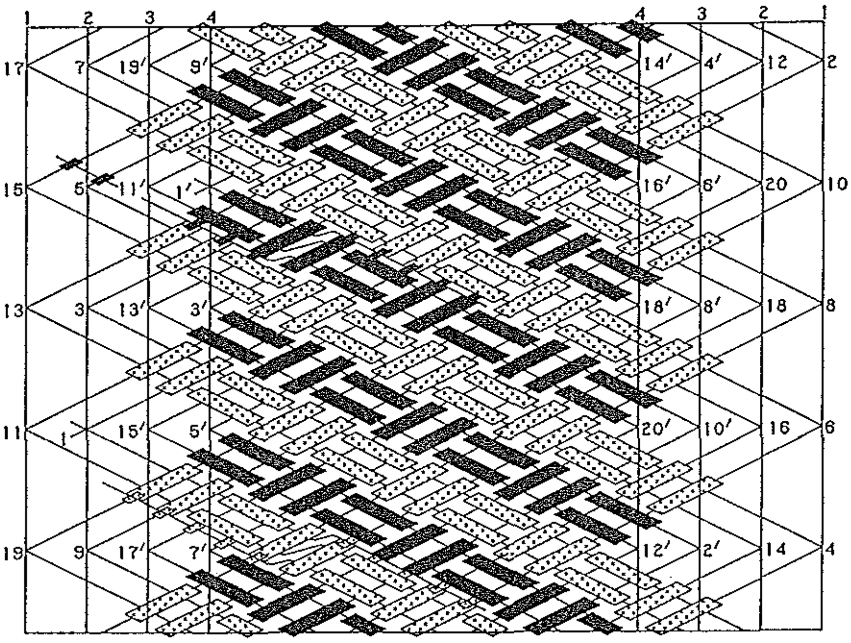
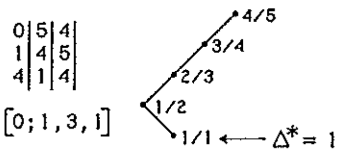
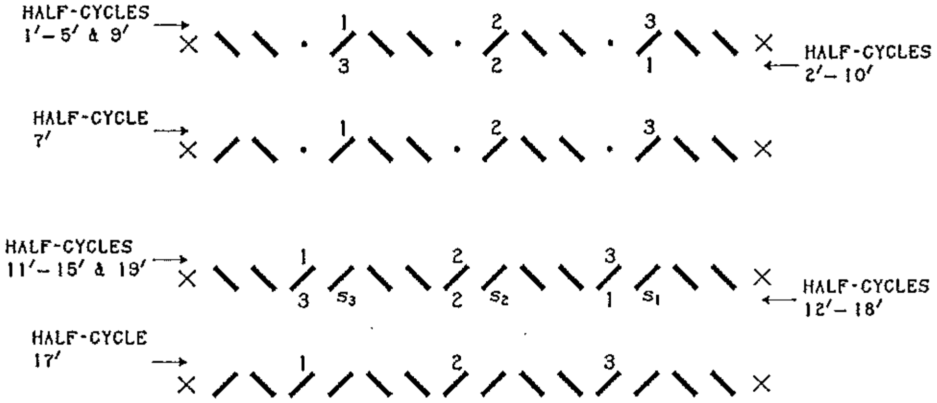


Fig. 926 — Grid-diagram of the knot over round bead at end of stem.

Next, we braid the doubled $p/b = 4/5$ Matthew Walker Knot between the bight-boundaries L_3 and L_4 on the left bight-edge and the bight-boundaries R_3 and R_4 on the right bight-edge as depicted in Fig. 926. Its associated half-cycle algorithm diagrams are:





From these algorithm diagrams we read the following half-cycle braiding algorithms:

half-cycle 1′ : $L_4 \longrightarrow R_3$: $8u$.
half-cycle 2′ : $i = 0$; $R_3 \longrightarrow L_4$: $8o$.
half-cycle 3′ : $i = 0$; $L_4 \longrightarrow R_3$: $8o$.
half-cycle 4′ : $i \leq 1$; $R_3 \longrightarrow L_4$: $2o - (s)u - 6o$.
half-cycle 5′ : $i \leq 1$; $L_4 \longrightarrow R_3$: $2u - o - 6u$.
half-cycle 6′ : $i \leq 2$; $R_3 \longrightarrow L_4$: $2o - u - 2o - (s)u - 4o$.
half-cycle 7′ : $i \leq 2$; $L_4 \longrightarrow R_3$: $o - u - o - 2u - o - 4u$.
half-cycle 8′ : $i \leq 3$; $R_3 \longrightarrow L_4$: $2o - u - 2o - u - 2o - (s)u - 2o$.
half-cycle 9′ : $i \leq 3$; $L_4 \longrightarrow R_3$: $2u - o - 2u - o - 2u - o - 2u$.
half-cycle 10′ : $i \leq 4$; $R_3 \longrightarrow L_3$: $2o - u - 2o - u - 2o - u - 2o$.
half-cycle 11′ : $L_3 \longrightarrow R_4$: $2u - o - 2u - o - 2u - o - 2u$.
half-cycle 12′ : $i = 0$; $R_4 \longrightarrow L_3$: $2o - u - 2o - u - 2o - u - 2o$.
half-cycle 13′ : $i = 0$; $L_3 \longrightarrow R_4$: $2u - o - 2u - o - 2u - o - 2u$.
half-cycle 14′ : $i \leq 1$; $R_4 \longrightarrow L_3$: $2o - (s,1)2u - 2o - u - 2o - u - 2o$.
half-cycle 15′ : $i \leq 1$; $L_3 \longrightarrow R_4$: $2u - 2o - 2u - o - 2u - o - 2u$.
half-cycle 16′ : $i \leq 2$; $R_4 \longrightarrow L_3$: $2o - 2u - 2o - (s,1)2u - 2o - u - 2o$.
half-cycle 17′ : $i \leq 2$; $L_3 \longrightarrow R_4$: $o - u - 2o - 2u - 2o - 2u - o - 2u$.
half-cycle 18′ : $i \leq 3$; $R_4 \longrightarrow L_3$: $2o - 2u - 2o - 2u - 2o - (s,1)2u - 2o$.
half-cycle 19′ : $i \leq 3$; $L_3 \longrightarrow R_4$: $2u - 2o - 2u - 2o - 2u - 2o - 2u$.
half-cycle 20′ : $i \leq 4$; $R_4 \longrightarrow L$: $2o - 2u - 2o - 2u - 2o - (4,s,2)7u$.

Then we braid the Standing-End of half-cycle 1 as $2u - 2o - 6u$ from upper L_2 to lower R, and the Standing-End of half-cycle 1′ as $2o - 6u$ from upper L_4 to lower R.

Braid Design

In *The Braider*, Issue No. 49, we discussed on pp. 1146-1148 Regular Knots with simple interbraided OT bight edges which showed on the outer cylindrical surface as a ring with a one under – one over pattern. Although this pattern has its place in certain applications, often we would require a more handsome pattern. The next step up from a one under – one over pattern is a two under – two over pattern, which is much more handsome. Such interbraided bight-edges are based on the 8-lead rond braid such as the $\rightarrow 2u - 2o | 2o - 2u \leftarrow$ round braid (see *The Braider*, Issue No. 7, pg. 152, Fig. 136), or such as the $\rightarrow u - o - 2u|2u - o - u \leftarrow$ round braid. Their respective OT-UT grid-diagrams can be depicted as in Fig. 927.

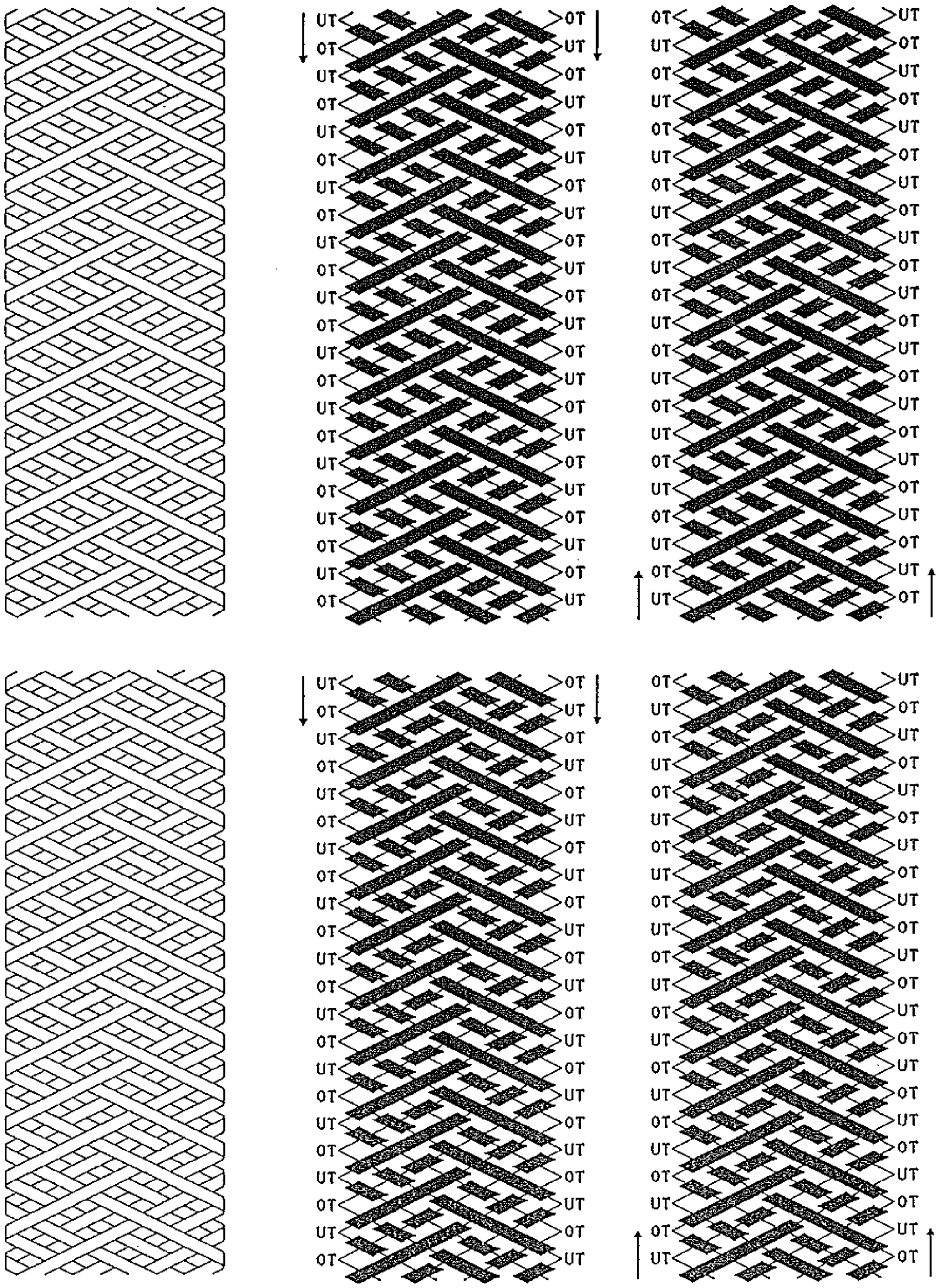

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Fig. 927 — Top row: $\rightarrow 2u - 2o|2o - 2u \leftarrow$.
Bottom row: $\rightarrow u - o - 2u|2u - o - u \leftarrow$.

When the right bight-edge of the left Regular Knot is interbraided with the left bight-edge of the right Regular Knot, then each of these Regular Knots should again have an even number of bights as for the reason explained in *The Braider*, Issue No. 49, pg. 1146. A few examples of such two under – two over interbraided bight-edges of Regular Knots are shown in Figs. 928, 929, 930, 931. Their respective braiding algorithm tables are on pp. 1184 - 1188.

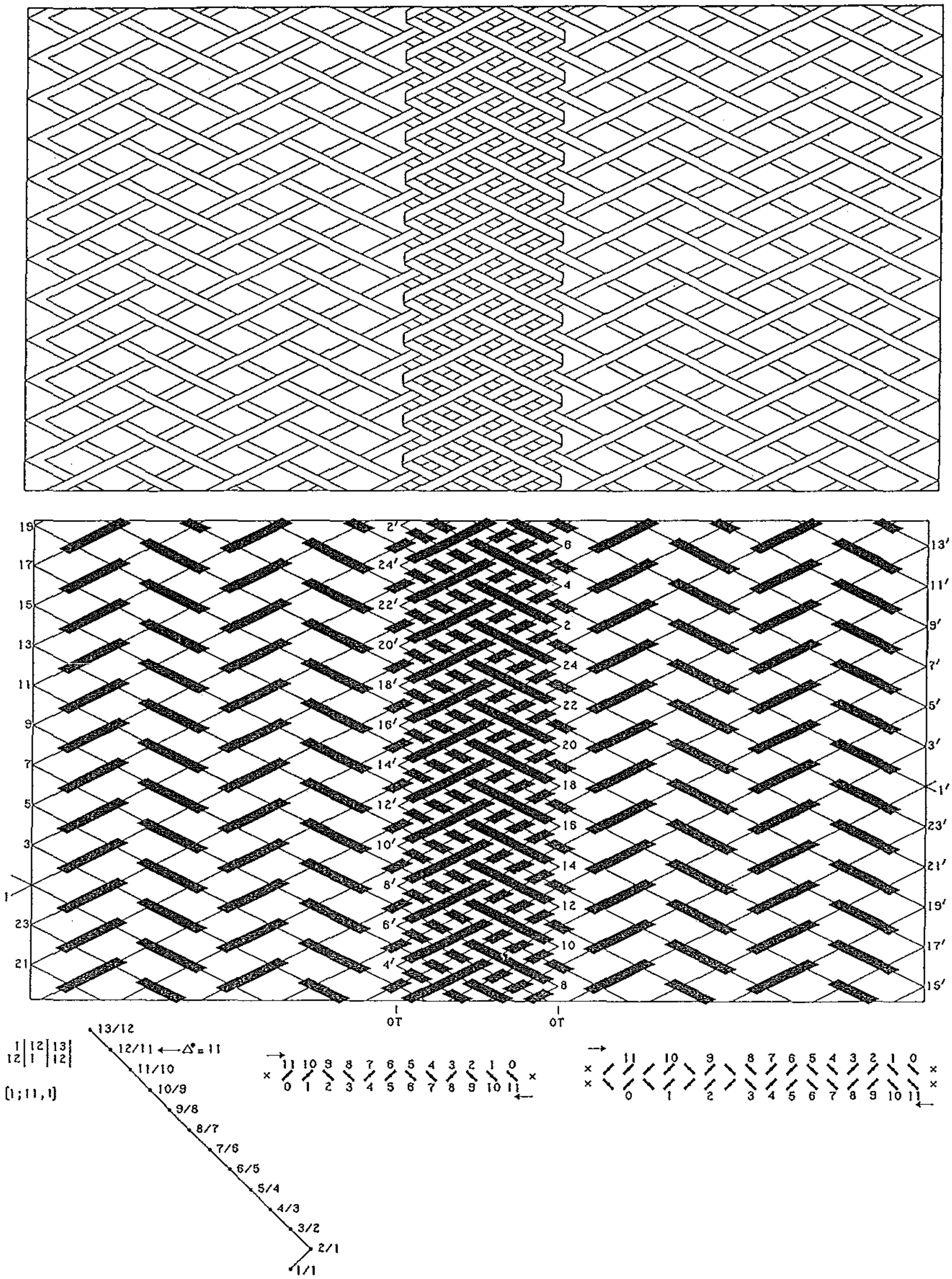

Fig. 928 — Example 1.

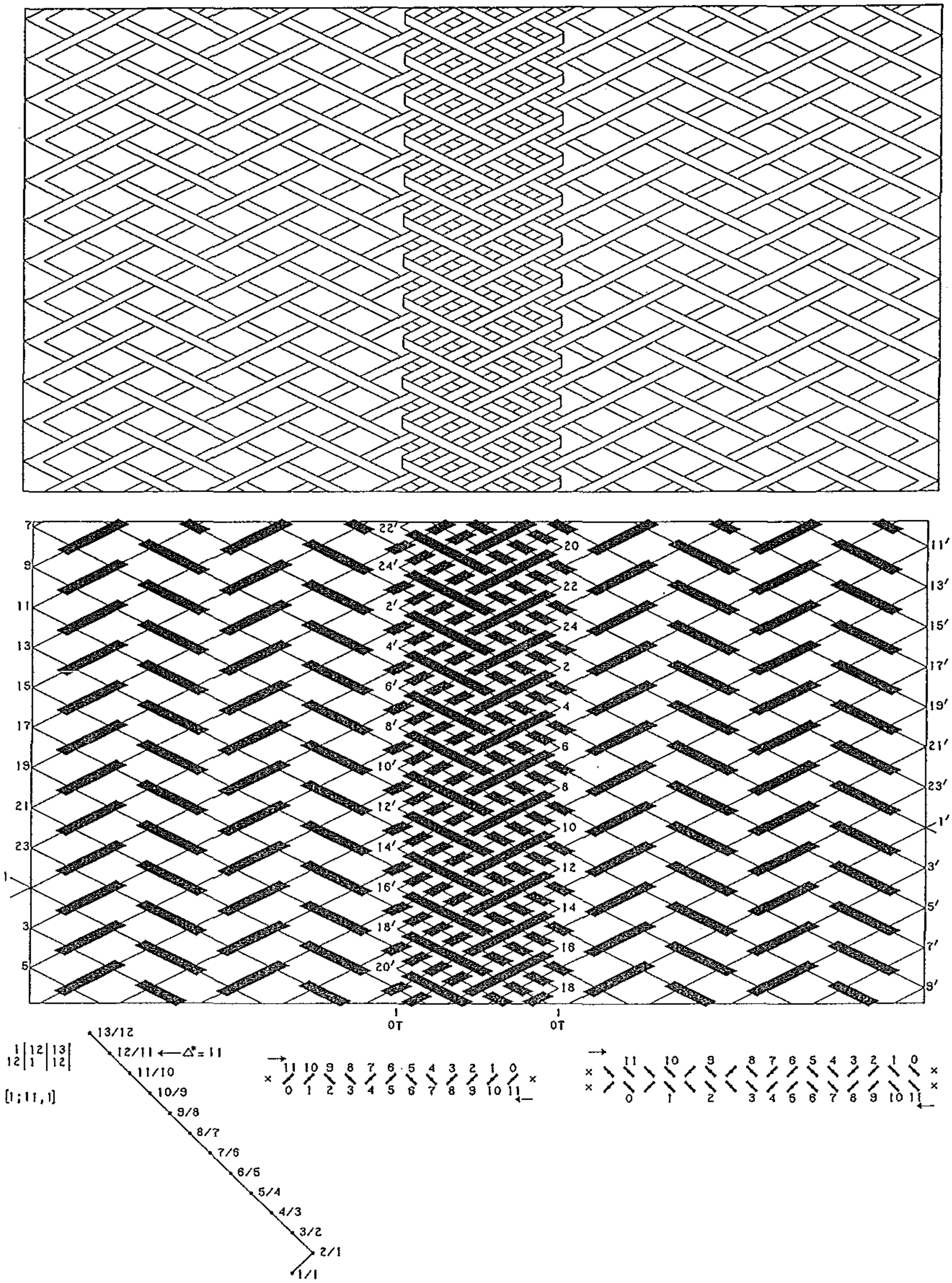

Fig. 929 — Example 2.

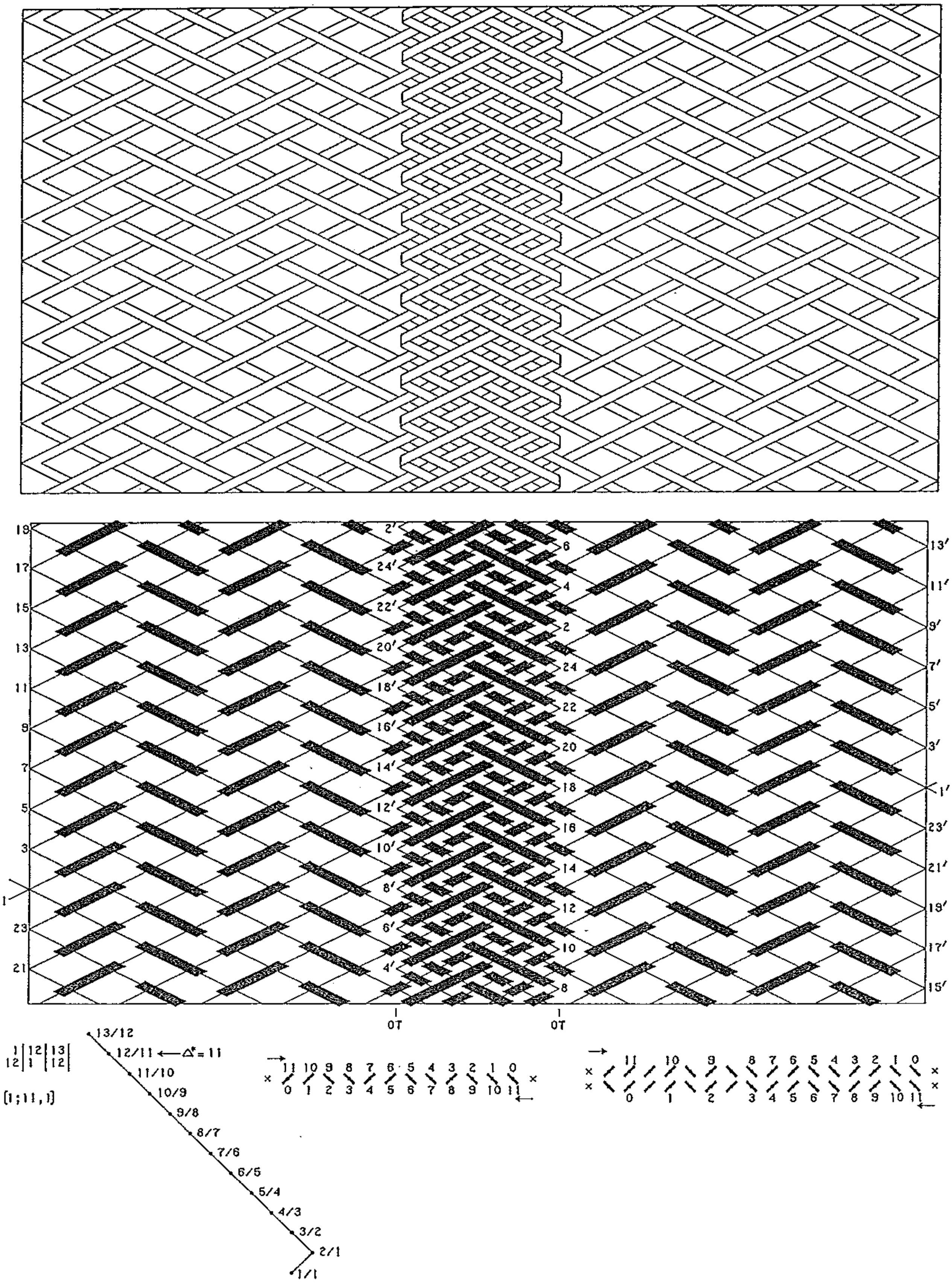

Fig. 930 — Example 3.

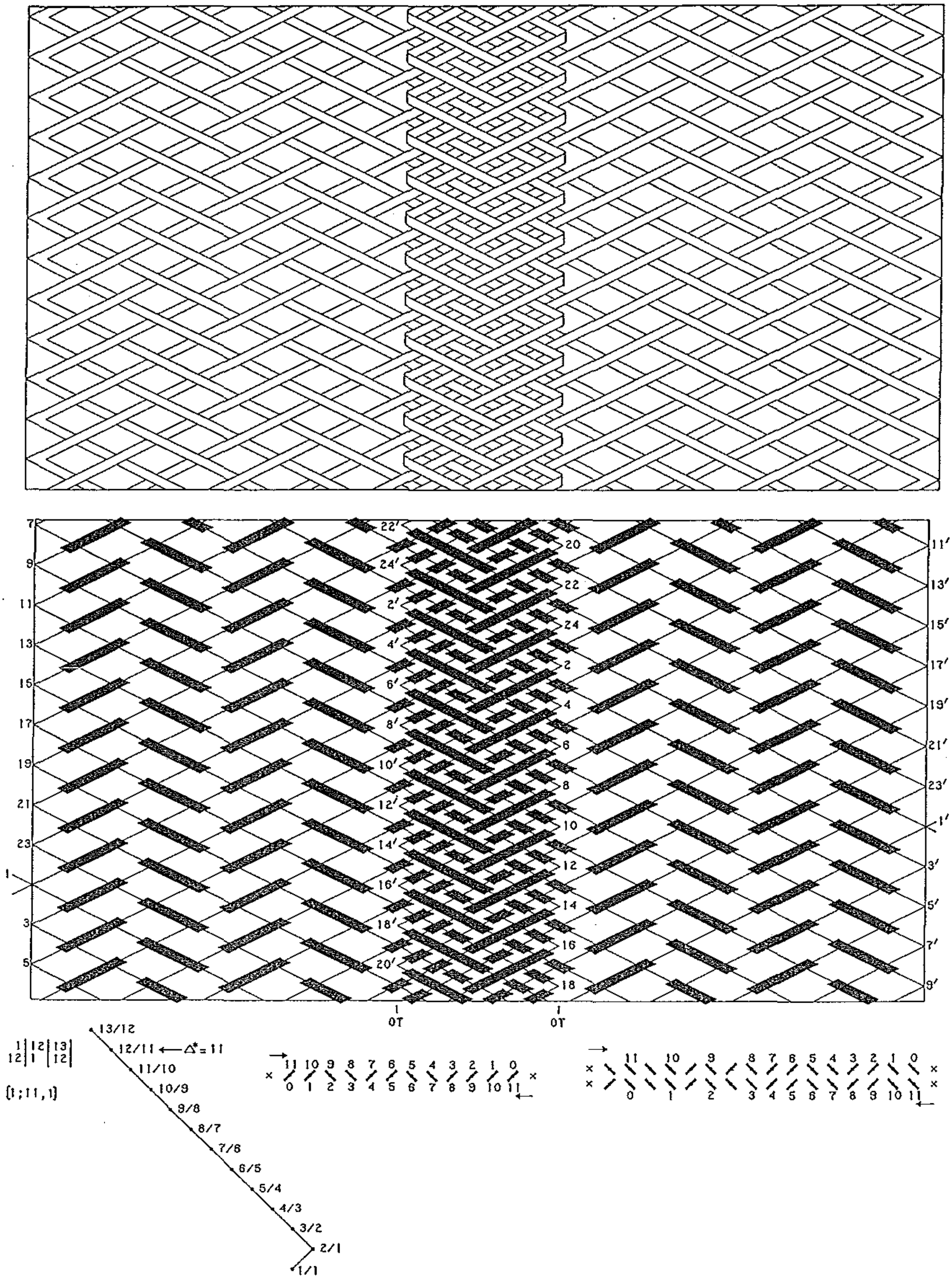

Fig. 931 — Example 4.

Half-cycle braiding algorithms for Example 1 (Fig. 928):

half-cycle 1: Free run.
half-cycle 2: $i = 0$: OT — $(s)u$.
half-cycle 3: $i = 0$: u.
half-cycle 4: $i \leq 1$: OT — $(s, 1)2u$.
half-cycle 5: $i \leq 1$: $2u$.
half-cycle 6: $i \leq 2$: OT — $(s)o - 2u$.
half-cycle 7: $i \leq 2$: $3u$.
half-cycle 8: $i \leq 3$: OT — $(s, 1)2o - 2u$.
half-cycle 9: $i \leq 3$: $o - 3u$.
half-cycle 10: $i \leq 4$: OT — $(s)u - 2o - 2u$.
half-cycle 11: $i \leq 4$: $u - o - 3u$.
half-cycle 12: $i \leq 5$: OT — $(s, 1)2u - 2o - 2u$.
half-cycle 13: $i \leq 5$: $2u - o - 3u$.
half-cycle 14: $i \leq 6$: OT — $(s)o - 2u - 2o - 2u$.
half-cycle 15: $i \leq 6$: $o - 2u - o - 3u$.
half-cycle 16: $i \leq 7$: OT — $(s, 1)2o - 2u - 2o - 2u$.
half-cycle 17: $i \leq 7$: $2o - 2u - o - 3u$.
half-cycle 18: $i \leq 8$: OT — $(s)u - 2o - 2u - 2o - 2u$.
half-cycle 19: $i \leq 8$: $u - 2o - 2u - o - 3u$.
half-cycle 20: $i \leq 9$: OT — $(s)o - u - 2o - 2u - 2o - 2u$.
half-cycle 21: $i \leq 9$: $2u - 2o - 2u - o - 3u$.
half-cycle 22: $i \leq 10$: OT — $(s, 1)2o - u - 2o - 2u - 2o - 2u$.
half-cycle 23: $i \leq 10$: $o - 2u - 2o - 2u - o - 3u$.
half-cycle 24: $i \leq 11$: OT — $(s, 2)3o - u - 2o - 2u - 2o - 2u$.

half-cycle 1′: $2u - 2o$.
half-cycle 2′: $i = 0$: OT — $2o - (2, s)3u$.
half-cycle 3′: $i = 0$: $2u - o - u - o$.
half-cycle 4′: $i \leq 1$: OT — $2o - (2, s, 1)4u$.
half-cycle 5′: $i \leq 1$: $3u - o - u - o$.
half-cycle 6′: $i \leq 2$: OT — $2o - 2u - (s)o - 2u$.
half-cycle 7′: $i \leq 2$: $4u - o - u - o$.
half-cycle 8′: $i \leq 3$: OT — $2o - 2u - (s, 1)2o - 2u$.
half-cycle 9′: $i \leq 3$: $o - 4u - o - u - o$.
half-cycle 10′: $i \leq 4$: OT — $2o - (2, s)3u - 2o - 2u$.
half-cycle 11′: $i \leq 4$: $u - o - 4u - o - u - o$.
half-cycle 12′: $i \leq 5$: OT — $2o - (2, s, 1)4u - 2o - 2u$.
half-cycle 13′: $i \leq 5$: $2u - o - 4u - o - u - o$.
half-cycle 14′: $i \leq 6$: OT — $2o - 2u - (s)o - 2u - 2o - 2u$.
half-cycle 15′: $i \leq 6$: $o - 2u - o - 4u - o - u - o$.
half-cycle 16′: $i \leq 7$: OT — $2o - 2u - (s, 1)2o - 2u - 2o - 2u$.
half-cycle 17′: $i \leq 7$: $2o - 2u - o - 4u - o - u - o$.
half-cycle 18′: $i \leq 8$: OT — $2o - (2, s)3u - 2o - 2u - 2o - 2u$.
half-cycle 19′: $i \leq 8$: $u - 2o - 2u - o - 4u - o - u - o$.
half-cycle 20′: $i \leq 9$: OT — $2o - u - (s)o - 2u - 2o - 2u - 2o - 2u$.
half-cycle 21′: $i \leq 9$: $2u - 2o - 2u - o - 4u - o - u - o$.
half-cycle 22′: $i \leq 10$: OT — $(2, s)3o - u - o - 2u - 2o - 2u - 2o - 2u$.
half-cycle 23′: $i \leq 10$: $o - 2u - 2o - 2u - o - 4u - o - u - o$.

half-cycle 24′: $i \le 11$: OT — $(1,s,2)4o - u - o - 2u - 2o - 2u - 2o - 2u$.

Half-cycle braiding algorithms for Example 2 (Fig. 929):

half-cycle 1: Free run.
half-cycle 2: $i = 0$: OT — $(s)o$.
half-cycle 3: $i = 0$: u.
half-cycle 4: $i \le 1$: OT — $(s,1)2o$.
half-cycle 5: $i \le 1$: $2u$.
half-cycle 6: $i \le 2$: OT — $(s)u - 2o$.
half-cycle 7: $i \le 2$: $3u$.
half-cycle 8: $i \le 3$: OT — $(s,1)2u - 2o$.
half-cycle 9: $i \le 3$: $4u$.
half-cycle 10: $i \le 4$: OT — $(s)o - 2u - 2o$.
half-cycle 11: $i \le 4$: $o - 4u$.
half-cycle 12: $i \le 5$: OT — $(s,1)2o - 2u - 2o$.
half-cycle 13: $i \le 5$: $2o - 4u$.
half-cycle 14: $i \le 6$: OT — $(s)u - 2o - 2u - 2o$.
half-cycle 15: $i \le 6$: $u - 2o - 4u$.
half-cycle 16: $i \le 7$: OT — $(s,1)2u - 2o - 2u - 2o$.
half-cycle 17: $i \le 7$: $2u - 2o - 4u$.
half-cycle 18: $i \le 8$: OT — $(s)o - 2u - 2o - 2u - 2o$.
half-cycle 19: $i \le 8$: $o - 2u - 2o - 4u$.
half-cycle 20: $i \le 9$: OT — $(s,1)2o - 2u - 2o - 2u - 2o$.
half-cycle 21: $i \le 9$: $2o - 2u - 2o - 4u$.
half-cycle 22: $i \le 10$: OT — $(s,2)3o - 2u - 2o - 2u - 2o$.
half-cycle 23: $i \le 10$: $u - 2o - 2u - 2o - 4u$.
half-cycle 24: $i \le 11$: OT — $(s,3)4o - 2u - 2o - 2u - 2o$.

half-cycle 1′: $2u - 2o$.
half-cycle 2′: $i = 0$: OT — $2o - 2u - (s)o$.
half-cycle 3′: $i = 0$: $2u - o - u - o$.
half-cycle 4′: $i \le 1$: OT — $2o - 2u - (s,1)2o$.
half-cycle 5′: $i \le 1$: $3u - o - u - o$.
half-cycle 6′: $i \le 2$: OT — $2o - (2,s)3u - 2o$.
half-cycle 7′: $i \le 2$: $4u - o - u - o$.
half-cycle 8′: $i \le 3$: OT — $2o - (2,s,1)4u - 2o$.
half-cycle 9′: $i \le 3$: $5u - o - u - o$.
half-cycle 10′: $i \le 4$: OT — $2o - 2u - (s)o - 2u - 2o$.
half-cycle 11′: $i \le 4$: $o - 5u - o - u - o$.
half-cycle 12′: $i \le 5$: OT — $2o - 2u - (s,1)2o - 2u - 2o$.
half-cycle 13′: $i \le 5$: $2u - 5u - o - u - o$.
half-cycle 14′: $i \le 6$: OT — $2o - (2,s)3u - 2o - 2u - 2o$.
half-cycle 15′: $i \le 6$: $u - 2o - 5u - o - u - o$.
half-cycle 16′: $i \le 7$: OT — $2o - (2,s,1)4u - 2o - 2u - 2o$.
half-cycle 17′: $i \le 7$: $2u - 2o - 5u - o - u - o$.
half-cycle 18′: $i \le 8$: OT — $2o - 2u - (s)o - 2u - 2o - 2u - 2o$.
half-cycle 19′: $i \le 8$: $o - 2u - 2o - 5u - o - u - o$.
half-cycle 20′: $i \le 9$: OT — $2o - u - (s)o - u - o - 2u - 2o - 2u - 2o$.
half-cycle 21′: $i \le 9$: $2o - 2u - 2o - 5u - o - u - o$.

half-cycle 22′: $i \leq 10$: OT — $(2,s)3o - u - o - u - o - 2u - 2o - 2u - 2o$.
half-cycle 23′: $i \leq 10$: $u - 2o - 2u - 2o - 5u - o - u - o$.
half-cycle 24′: $i \leq 11$: OT — $(1,s,2)4o - u - o - u - o - 2u - 2o - 2u - 2o$.

Half-cycle braiding algorithms for Example 3 (Fig. 930):

half-cycle 1: Free run.
half-cycle 2: $i = 0$: OT — $(s)u$.
half-cycle 3: $i = 0$: u.
half-cycle 4: $i \leq 1$: OT — $(s,1)2u$.
half-cycle 5: $i \leq 1$: $2u$.
half-cycle 6: $i \leq 2$: OT — $(s)o - 2u$.
half-cycle 7: $i \leq 2$: $3u$.
half-cycle 8: $i \leq 3$: OT — $(s,1)2o - 2u$.
half-cycle 9: $i \leq 3$: $o - 3u$.
half-cycle 10: $i \leq 4$: OT — $(s)u - 2o - 2u$.
half-cycle 11: $i \leq 4$: $u - o - 3u$.
half-cycle 12: $i \leq 5$: OT — $(s,1)2u - 2o - 2u$.
half-cycle 13: $i \leq 5$: $2u - o - 3u$.
half-cycle 14: $i \leq 6$: OT — $(s)o - 2u - 2o - 2u$.
half-cycle 15: $i \leq 6$: $o - 2u - o - 3u$.
half-cycle 16: $i \leq 7$: OT — $(s,1)2o - 2u - 2o - 2u$.
half-cycle 17: $i \leq 7$: $2o - 2u - o - 3u$.
half-cycle 18: $i \leq 8$: OT — $(s)u - 2o - 2u - 2o - 2u$.
half-cycle 19: $i \leq 8$: $u - 2o - 2u - o - 3u$.
half-cycle 20: $i \leq 9$: OT — $(s)o - u - 2o - 2u - 2o - 2u$.
half-cycle 21: $i \leq 9$: $2u - 2o - 2u - o - 3u$.
half-cycle 22: $i \leq 10$: OT — $(s,1)2o - u - 2o - 2u - 2o - 2u$.
half-cycle 23: $i \leq 10$: $o - 2u - 2o - 2u - o - 3u$.
half-cycle 24: $i \leq 11$: OT — $(s,2)3o - u - 2o - 2u - 2o - 2u$.

half-cycle 1′: $u - o - u - o$.
half-cycle 2′: $i = 0$: OT — $2o - (2,s)3u$.
half-cycle 3′: $i = 0$: $u - o - 2u - o$.
half-cycle 4′: $i \leq 1$: OT — $2o - (2,s,1)4u$.
half-cycle 5′: $i \leq 1$: $u - o - 3u - o$.
half-cycle 6′: $i \leq 2$: OT — $2o - 2u - (s)o - 2u$.
half-cycle 7′: $i \leq 2$: $2u - o - 3u - o$.
half-cycle 8′: $i \leq 3$: OT — $2o - 2u - (s,1)2o - 2u$.
half-cycle 9′: $i \leq 3$: $o - 2u - o - 3u - o$.
half-cycle 10′: $i \leq 4$: OT — $2o - (2,s)3u - 2o - 2u$.
half-cycle 11′: $i \leq 4$: $u - o - 2u - o - 3u - o$.
half-cycle 12′: $i \leq 5$: OT — $2o - (2,s,1)4u - 2o - 2u$.
half-cycle 13′: $i \leq 5$: $2u - o - 2u - o - 3u - o$.
half-cycle 14′: $i \leq 6$: OT — $2o - 2u - (s)o - 2u - 2o - 2u$.
half-cycle 15′: $i \leq 6$: $o - 2u - o - 2u - o - 3u - o$.
half-cycle 16′: $i \leq 7$: OT — $2o - 2u - (s,1)2o - 2u - 2o - 2u$.
half-cycle 17′: $i \leq 7$: $2o - 2u - o - 2u - o - 3u - o$.
half-cycle 18′: $i \leq 8$: OT — $2o - (2,s)3u - 2o - 2u - 2o - 2u$.
half-cycle 19′: $i \leq 8$: $u - 2o - 2u - o - 2u - o - 3u - o$.

half-cycle $20'$: $i \leq 9$: OT — $2o - u - (s)o - 2u - 2o - 2u - 2o - 2u$.
half-cycle $21'$: $i \leq 9$: $2u - 2o - 2u - o - 2u - o - 3u - o$.
half-cycle $22'$: $i \leq 10$: OT — $(2,s)3o - u - o - 2u - 2o - 2u - 2o - 2u$.
half-cycle $23'$: $i \leq 10$: $o - 2u - 2o - 2u - o - 2u - o - 3u - o$.
half-cycle $24'$: $i \leq 11$: OT — $(1,s,2)4o - u - o - 2u - 2o - 2u - 2o - 2u$.

Half-cycle braiding algorithms for Example 4 (Fig. 931):

half-cycle 1: Free run.
half-cycle 2: $i = 0$: OT — $(s)o$.
half-cycle 3: $i = 0$: u.
half-cycle 4: $i \leq 1$: OT — $(s,1)2o$.
half-cycle 5: $i \leq 1$: $2u$.
half-cycle 6: $i \leq 2$: OT — $(s)u - 2o$.
half-cycle 7: $i \leq 2$: $3u$.
half-cycle 8: $i \leq 3$: OT — $(s,1)2u - 2o$.
half-cycle 9: $i \leq 3$: $4u$.
half-cycle 10: $i \leq 4$: OT — $(s)o - 2u - 2o$.
half-cycle 11: $i \leq 4$: $o - 4u$.
half-cycle 12: $i \leq 5$: OT — $(s,1)2o - 2u - 2o$.
half-cycle 13: $i \leq 5$: $2o - 4u$.
half-cycle 14: $i \leq 6$: OT — $(s)u - 2o - 2u - 2o$.
half-cycle 15: $i \leq 6$: $u - 2o - 4u$.
half-cycle 16: $i \leq 7$: OT — $(s,1)2u - 2o - 2u - 2o$.
half-cycle 17: $i \leq 7$: $2u - 2o - 4u$.
half-cycle 18: $i \leq 8$: OT — $(s)o - 2u - 2o - 2u - 2o$.
half-cycle 19: $i \leq 8$: $o - 2u - 2o - 4u$.
half-cycle 20: $i \leq 9$: OT — $(s,1)2o - 2u - 2o - 2u - 2o$.
half-cycle 21: $i \leq 9$: $2o - 2u - 2o - 4u$.
half-cycle 22: $i \leq 10$: OT — $(s,2)3o - 2u - 2o - 2u - 2o$.
half-cycle 23: $i \leq 10$: $u - 2o - 2u - 2o - 4u$.
half-cycle 24: $i \leq 11$: OT — $(s,3)4o - 2u - 2o - 2u - 2o$.

half-cycle $1'$: $u - o - u - o$.
half-cycle $2'$: $i = 0$: OT — $2o - 2u - (s)o$.
half-cycle $3'$: $i = 0$: $u - o - 2u - o$.
half-cycle $4'$: $i \leq 1$: OT — $2o - 2u - (s,1)2o$.
half-cycle $5'$: $i \leq 1$: $u - o - 3u - o$.
half-cycle $6'$: $i \leq 2$: OT — $2o - (2,s)3u - 2o$.
half-cycle $7'$: $i \leq 2$: $2u - o - 3u - o$.
half-cycle $8'$: $i \leq 3$: OT — $2o - (2,s,1)4u - 2o$.
half-cycle $9'$: $i \leq 3$: $3u - o - 3u - o$.
half-cycle $10'$: $i \leq 4$: OT — $2o - 2u - (s)o - 2u - 2o$.
half-cycle $11'$: $i \leq 4$: $o - 3u - o - 3u - o$.
half-cycle $12'$: $i \leq 5$: OT — $2o - 2u - (s,1)2o - 2u - 2o$.
half-cycle $13'$: $i \leq 5$: $2u - 3u - o - 3u - o$.
half-cycle $14'$: $i \leq 6$: OT — $2o - (2,s)3u - 2o - 2u - 2o$.
half-cycle $15'$: $i \leq 6$: $u - 2o - 3u - o - 3u - o$.
half-cycle $16'$: $i \leq 7$: OT — $2o - (2,s,1)4u - 2o - 2u - 2o$.
half-cycle $17'$: $i \leq 7$: $2u - 2o - 3u - o - 3u - o$.

half-cycle 18′: $i \le 8$: OT — $2o - 2u - (s)o - 2u - 2o - 2u - 2o$.

half-cycle 19′: $i \le 8$: $o - 2u - 2o - 3u - o - 3u - o$.

half-cycle 20′: $i \le 9$: OT — $2o - u - (s)o - u - o - 2u - 2o - 2u - 2o$.

half-cycle 21′: $i \le 9$: $2o - 2u - 2o - 3u - o - 3u - o$.

half-cycle 22′: $i \le 10$: OT — $(2,s)3o - u - o - u - o - 2u - 2o - 2u - 2o$.

half-cycle 23′: $i \le 10$: $u - 2o - 2u - 2o - 3u - o - 3u - o$.

half-cycle 24′: $i \le 11$: OT — $(1,s,2)4o - u - o - u - o - 2u - 2o - 2u - 2o$.

The reader will have noticed that in the simple Hour-glass Knot described in *The Braider*, Issue No. 49, pp. 1160-1163, Fig. 910, the interbraided knots in the leftmost and rightmost bight-edges of the $p/b = 9/10$ under-over coded knots required two essential strings each since their $p'/b = 2/10$ (g.c.d.$(p', b) = 2$). In practice we would, of course, prefer one essntial string for a knot which interbraids a bight-edge. Since $b =$ even, we then require $p' =$ odd, with g.c.d.$(p', b) = 1$. If we base these bight-edge interbraids on the 6-lead $\rightarrow u - 2o | 2o - u \leftarrow$ round braid (See *The Braider*, Issue No. 7, pg. 150, Fig. 132), then the interbraided knot $p'/10$ in the bight-edge of the $p/b = p/10$ knot will require one essential string only when its $p' = 3$ while $p = 11$ say. Such an improved simple Hour-glass Knot is shown in Fig. 933. Its half-cycle braiding algorithms are then as follows:

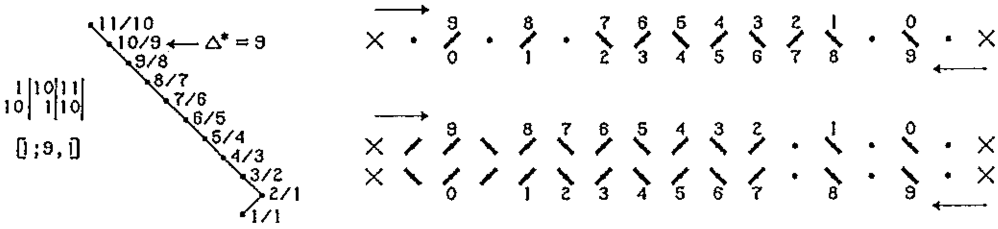

Fig. 932 — Upper algorithm diagram for the half-cycles 1 - 20.
Lower algorithm diagram for the half-cycles 1″ - 20″.

half-cycle 1 : Free run.

half-cycle 2 : $i = 0$: OT — $(s)u$.

half-cycle 3 : $i = 0$: OT — u.

half-cycle 4 : $i \le 1$: OT — $(s,1)2u$.

half-cycle 5 : $i \le 1$: OT — $2u$.

half-cycle 6 : $i \le 2$: OT — $(s)o - 2u$.

half-cycle 7 : $i \le 2$: OT — $o - 2u$.

half-cycle 8 : $i \le 3$: OT — $(s)u - o - 2u$.

half-cycle 9 : $i \le 3$: OT — $u - o - 2u$.

half-cycle 10 : $i \le 4$: OT — $(s)o - u - o - 2u$.

half-cycle 11 : $i \le 4$: OT — $o - u - o - 2u$.

half-cycle 12 : $i \le 5$: OT — $(s)u - o - u - o - 2u$.

half-cycle 13 : $i \le 5$: OT — $u - o - u - o - 2u$.

half-cycle 14 : $i \le 6$: OT — $(s)o - u - o - u - o - 2u$.

half-cycle 15 : $i \le 6$: OT — $o - u - o - u - o - 2u$.

half-cycle 16 : $i \le 7$: OT — $(s)u - o - u - o - u - o - 2u$.

half-cycle 17 : $i \le 7$: OT — $u - o - u - o - u - o - 2u$.

half-cycle 18 : $i \le 8$: OT — $(s)o - u - o - u - o - u - o - 2u$.

half-cycle 19 : $i \le 8$: OT — $o - u - o - u - o - u - o - 2u$.

half-cycle 20 : $i \le 9$: OT — $(s,1)2o - u - o - u - o - u - o - 2u$.

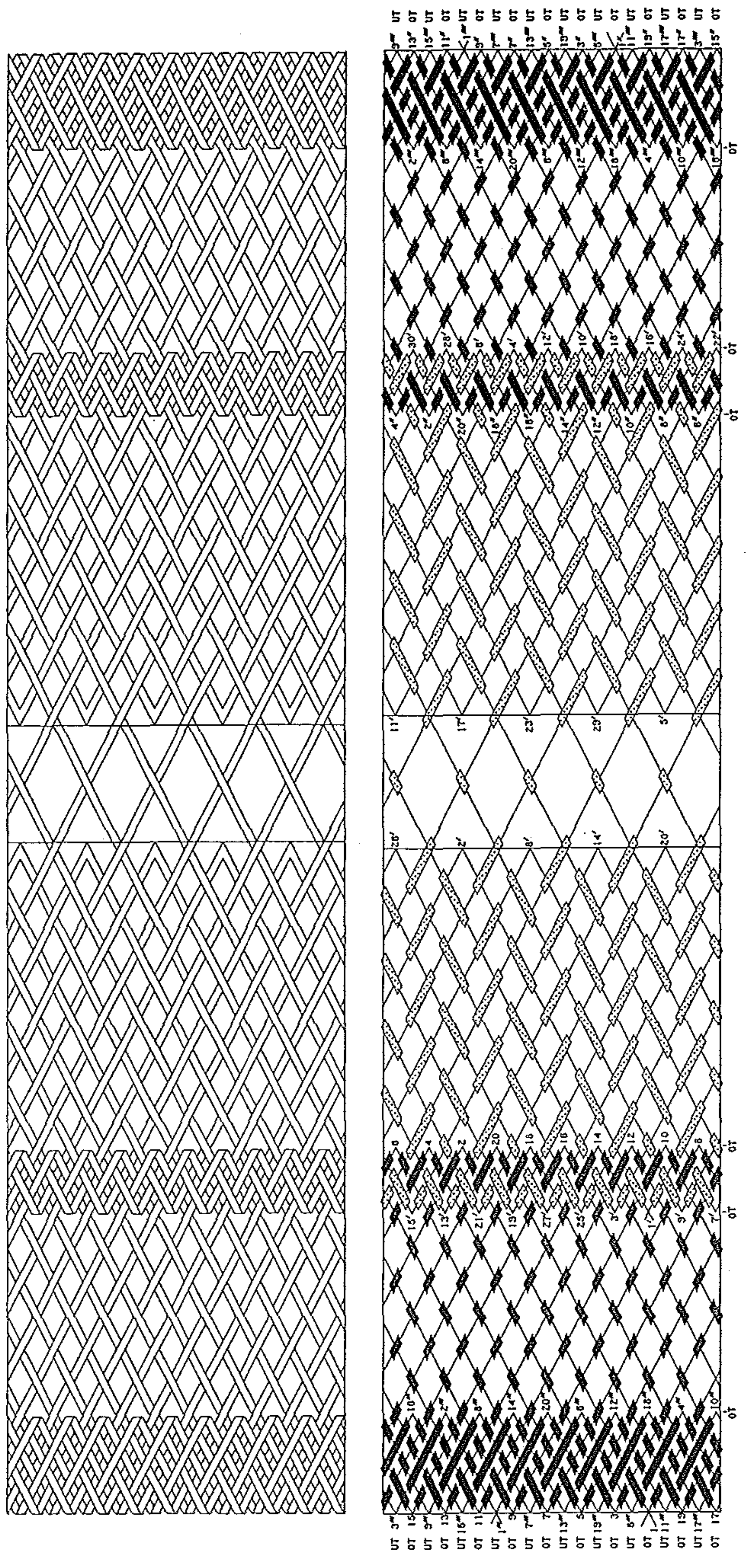

Fig. 933 — The modified simple Hour-glass Knot.

Half-cycles $1'$ - $30'$ as in *The Braider*, Issue No. 49, pp. 1160 - 1161.

half-cycle $1''$: $u - o$.
half-cycle $2''$: $i = 0$: OT — $o - (1,s)2u$.
half-cycle $3''$: $i = 0$: OT — $2u - o$.
half-cycle $4''$: $i \leq 1$: OT — $o - (1,s,1)3u$.
half-cycle $5''$: $i \leq 1$: OT — $3u - o$.
half-cycle $6''$: $i \leq 2$: OT — $o - u - (s)o - 2u$.
half-cycle $7''$: $i \leq 2$: OT — $o - 3u - o$.
half-cycle $8''$: $i \leq 3$: OT — $o - (1,s)2u - o - 2u$.
half-cycle $9''$: $i \leq 3$: OT — $u - o - 3u - o$.
half-cycle $10''$: $i \leq 4$: OT — $o - u - (s)o - u - o - 2u$.
half-cycle $11''$: $i \leq 4$: OT — $o - u - o - 3u - o$.
half-cycle $12''$: $i \leq 5$: OT — $o - (1,s)2u - o - u - o - 2u$.
half-cycle $13''$: $i \leq 5$: OT — $u - o - u - o - 3u - o$.
half-cycle $14''$: $i \leq 6$: OT — $o - u - (s)o - u - o - u - o - 2u$.
half-cycle $15''$: $i \leq 6$: OT — $o - u - o - u - o - 3u - o$.
half-cycle $16''$: $i \leq 7$: OT — $o - (1,s)2u - o - u - o - u - o - 2u$.
half-cycle $17''$: $i \leq 7$: OT — $u - o - u - o - u - o - 3u - o$.
half-cycle $18''$: $i \leq 8$: OT — $o - u - (s)o - u - o - u - o - u - o - 2u$.
half-cycle $19''$: $i \leq 8$: OT — $o - u - o - u - o - u - o - 3u - o$.
half-cycle $20''$: $i \leq 9$: OT — $(1,s)2o - u - o - u - o - u - o - u - o - 2u$.

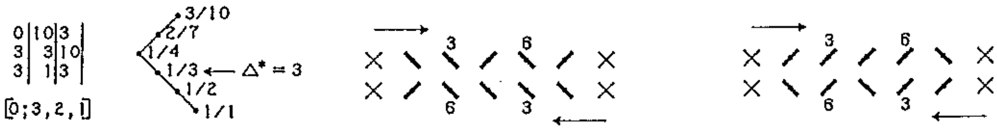

Fig. 934 — Left algorithm diagram for the half-cycles $1'''$ - $20'''$.
Right algorithm diagram for the half-cycles $1''''$ - $20''''$.

half-cycle $1'''$: $u - 2o$.
half-cycle $2'''$: OT — $2o - u$.
half-cycle $3'''$.: UT — $u - 2o$.
half-cycle $4'''$: OT — $2o - u$.
half-cycle $5'''$: UT — $u - 2o$.
half-cycle $6'''$: OT — $2o - u$.
half-cycle $7'''$: UT — $u - 2o$.
half-cycle $8'''$: OT — $(1,s,1)3o - u$.
half-cycle $9'''$: UT — $2u - 2o$.
half-cycle $10'''$: OT — $3o - u$.
half-cycle $11'''$: UT — $2u - 2o$.
half-cycle $12'''$: OT — $3o - u$.
half-cycle $13'''$: UT — $2u - 2o$.
half-cycle $14'''$: OT — $(3,s)4o - u$.
half-cycle $15'''$: UT — $2u - o - u - o$.
half-cycle $16'''$: OT — $4o - u$.
half-cycle $17'''$: UT — $2u - o - u - o$.
half-cycle $18'''$: OT — $4o - u$.
half-cycle $19'''$: UT — $2u - o - u - o$.
half-cycle $20'''$: OT — $4o - u$.

The half-cycle braiding algorithms for the $p'/b = 3/10$ rightmost edge interbraid (the half-cycles $1''''$ - $20''''$) are identical to the half-cycle braiding algorithms for the $p'/b = 3/10$ leftmost edge interbraid (the half-cycles $1'''$ - $20'''$).

Not only do these leftmost and rightmost edge interbraids require one string each only, but the resulting edges are aesthetically much superior.

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pg.

A Braiding Project — Key-hanger No.4 1191

Braid Design 1210

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for
the braiding artisan

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A Braiding Project — Key-hanger No. 4

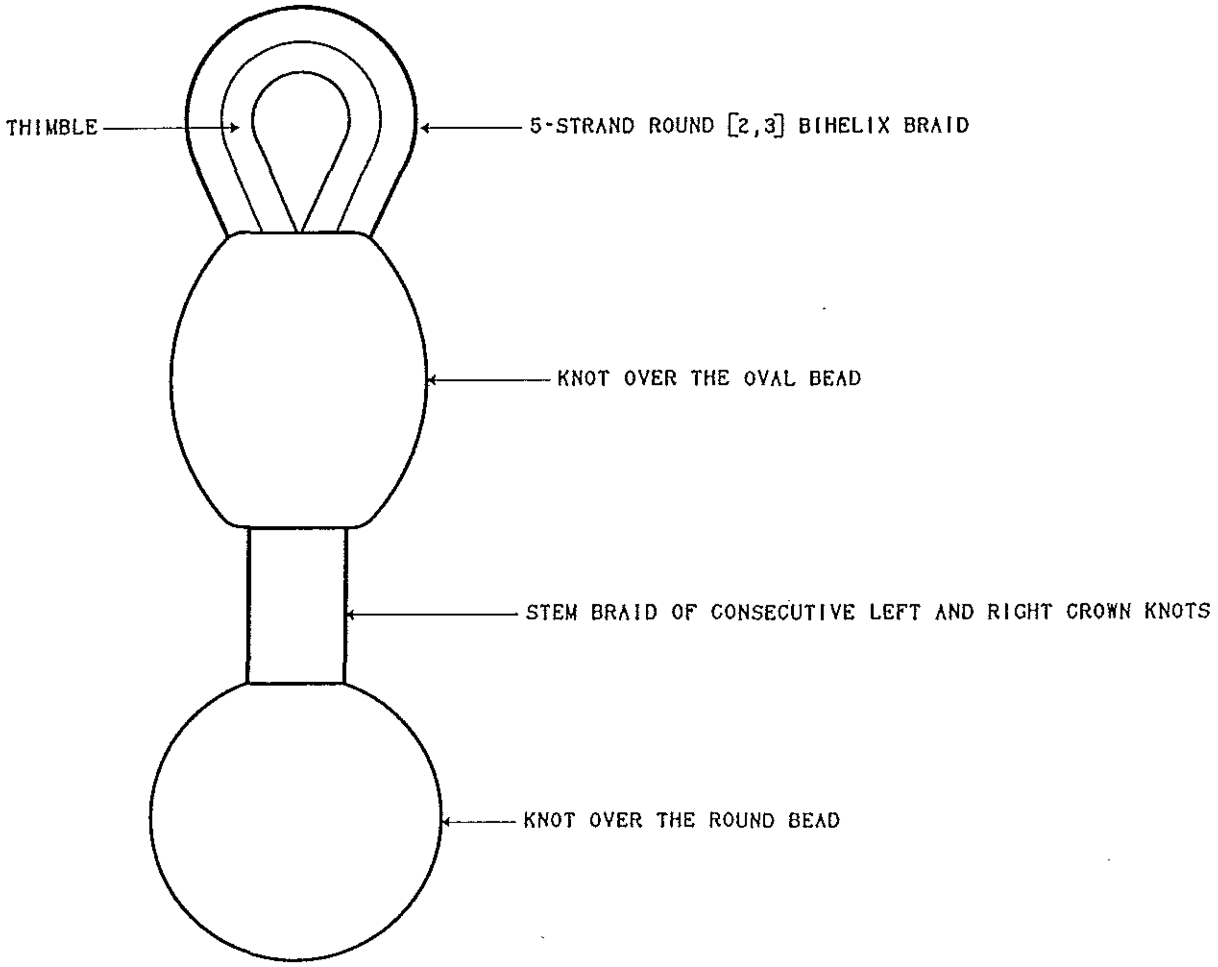

THIMBLE
5-STRAND ROUND [2,3] BIHELIX BRAID
KNOT OVER THE OVAL BEAD
STEM BRAID OF CONSECUTIVE LEFT AND RIGHT CROWN KNOTS
KNOT OVER THE ROUND BEAD

Fig. 935 — Key-hanger No. 4. Cord diameter 2 mm.

The braid forming the eye around the thimble of 25 mm. is a 5-cord [2, 3] Round Bihelix Braid as shown in Fig. 937[†], made at the centre of the cord lengths (cords approximately 60 cm. in length). This braid is put tightly around the thimble and both its 'ends' are then being secured together with the aid of a Double Constrictor Knot[‡] immediately below the thimble. The eight ends of the four cords having the same colour are placed around the two ends of the other coloured cord and this assembly is then wrapped over a length of 20 mm. with a single layer of tape. Over this we press a 26 mm. long oval bead, the hole of which has been enlarged to 8 mm.. This oval bead gets locked by the braid of the stem against the thimble with its 5 cord Round Bihelix Braid. The braid of the stem will be constructed from the eight cord-ends of the same colour. The two cord-ends of the other coloured string will serve as the core of the stem braid. The braid of the stem begins immediately below the oval bead and, as already mentioned, locks this bead firmly against the thimble with its 5-cord [2, 3] Round Bihelix Braid. The stem-braid consists of a sequence of alternating right and left 8-strand Crown Knots as shown in Figs. 936.

[†] Refer to *The Braider*, Issue No. 47, pp. 1114-1116.

[‡] See *The Braider*, Issue No. 47, pg. 1100, Fig. 845.

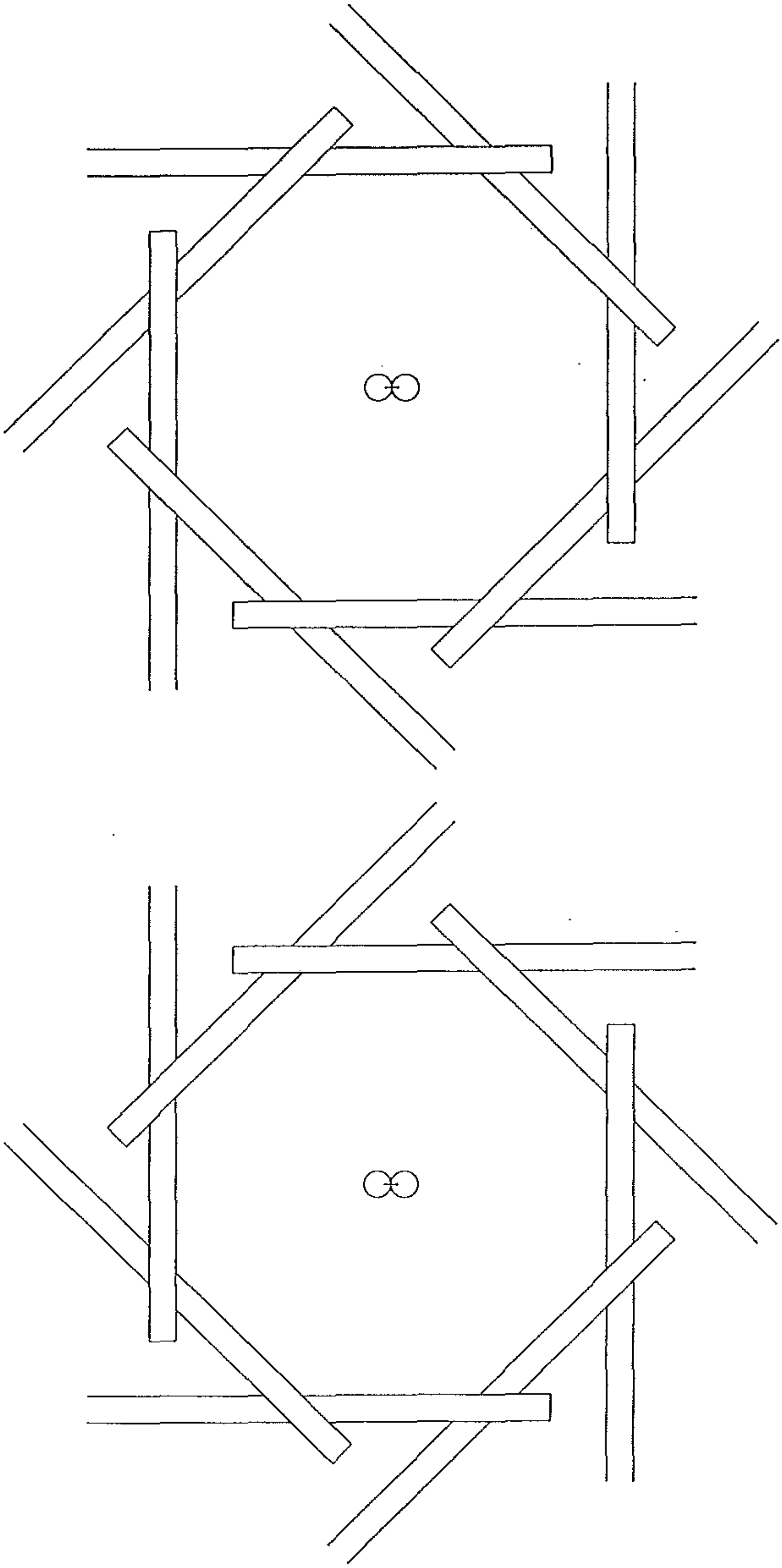


Fig. 936 — The alternating 8-strand right and left Crown Knots.

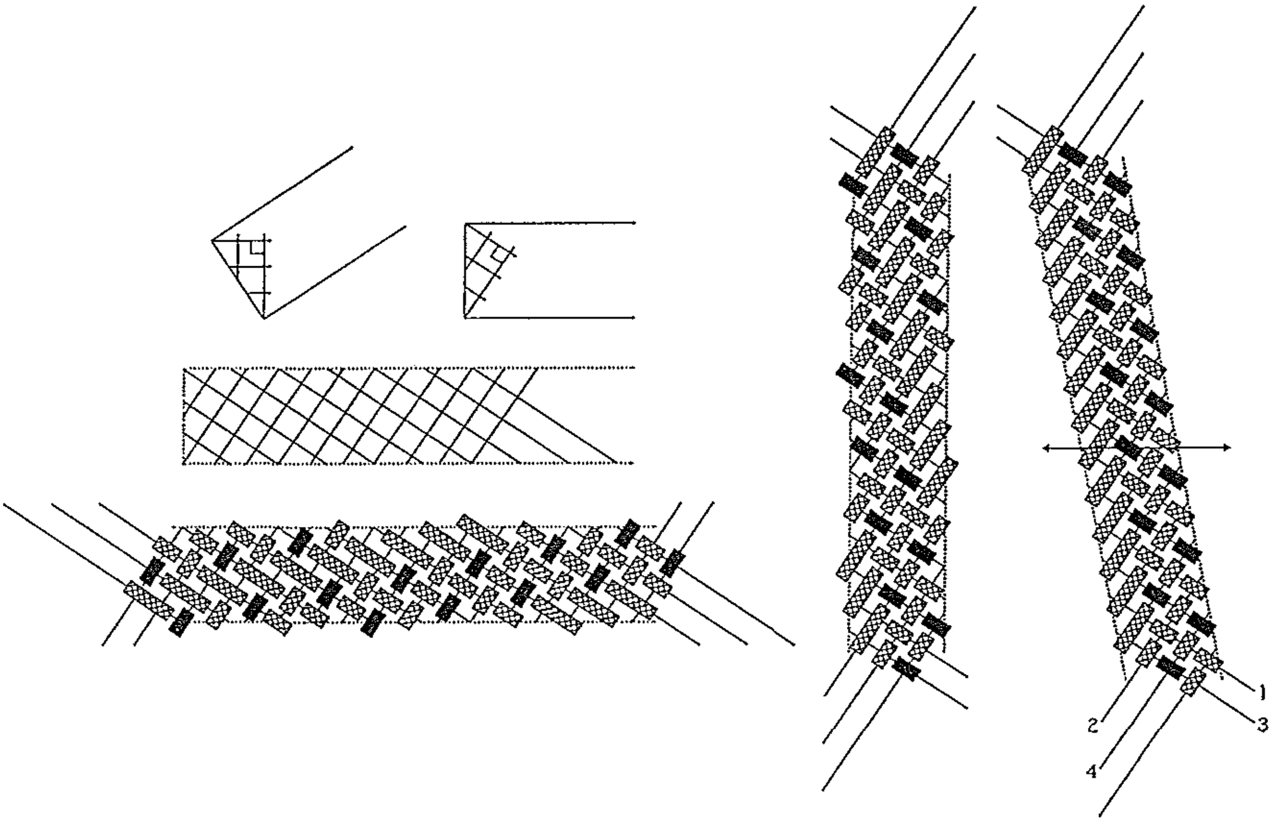


Fig. 937 — The 5-string Round Bihelix Braid with $[n_l, n_r] = [2, 3]$.

The nominal grid-diagram of the knot over the oval bead, immediately below the thimble, is depicted in Fig. 938 (left bight-edge towards thimble).

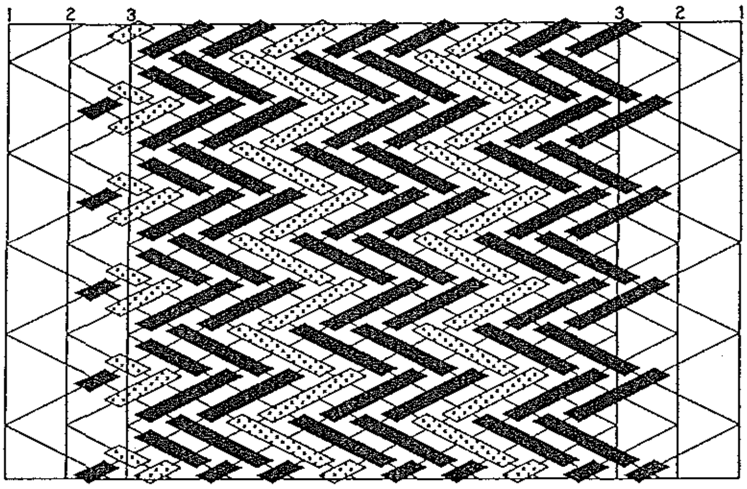


Fig. 938 — Nominal grid-diagram of the knot over oval bead adjacent to thimble.

The string-run specification of this Regular Nested Knot is (22/16/22){132/123}15. Fig. 939 depicts one of the ways in which this knot may be braided. Note that this knot is an interbraid of a $p/b = 8/5$ over-under coded Regular Knot with two $p/b = 6/5$ over-under coded Regular Knots.

We braid this Regular Nested Knot first as depicted in Fig. 940 and after it has been completed in this manner, we partly rebraid the half-cycles 10, 10′, 10″ as shown in Fig. 939. Then we braid the Standing Ends of half-cycles 1, 1′, 1″ as shown in Fig. 939.

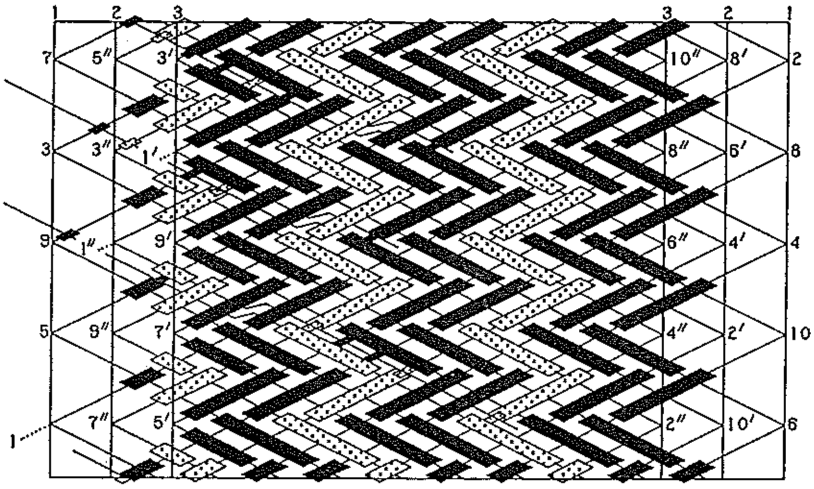


Fig. 939 — The grid-diagram of the knot over oval bead adjacent to thimble.

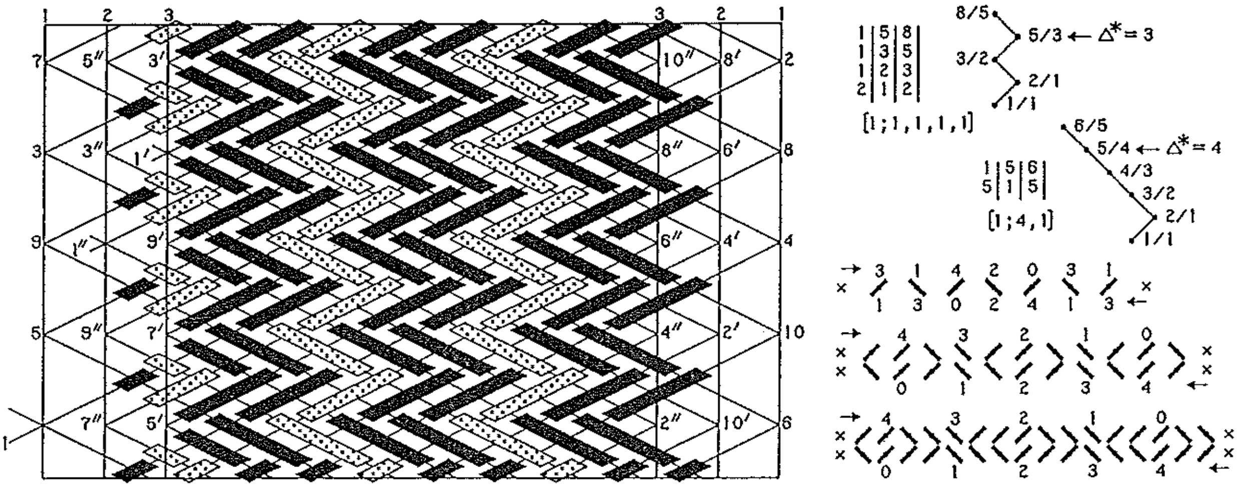


Fig. 940 — The initial braiding of the knot over oval bead adjacent to thimble.

Braiding begins with the $p/b = 8/5$ over-under coded Regular Knot between the bight-boundaries L_1 and R_1 as depicted in Fig. 940. Its half-cycle braiding algorithms, read from the uppermost algorithm diagram, are:

half-cycle 1 : $L_1 \longrightarrow R_1$: Free run.
half-cycle 2 : $i = 0$; $R_1 \longrightarrow L_1$: $(s)u$.
half-cycle 3 : $i = 0$; $L_1 \longrightarrow R_1$: o .
half-cycle 4 : $i \leq 1$; $R_1 \longrightarrow L_1$: $(s)o - (1,s)2u$.
half-cycle 5 : $i \leq 1$; $L_1 \longrightarrow R_1$: $u - 2o$.
half-cycle 6 : $i \leq 2$; $R_1 \longrightarrow L_1$: $(1,s)2o - 2u$.
half-cycle 7 : $i \leq 2$; $L_1 \longrightarrow R_1$: $2u - 2o$.
half-cycle 8 : $i \leq 3$; $R_1 \longrightarrow L_1$: $(s)u - 2o - u - (s)o - u$.
half-cycle 9 : $i \leq 3$; $L_1 \longrightarrow R_1$: $o - 2u - o - u - o$.
half-cycle 10 : $i \leq 4$; $R_1 \longrightarrow L_1$: $u - o - (s)u - o - u - o - u$.

Next we braid the half-cycles 1′ to 10′ of the $p/b = 6/5$ over-under coded Regular Knot between the bight-boundaries L_3 and R_2 as depicted in Fig. 940. Its half-cycle braiding algorithms, read from the algorithm diagram immediately below the uppermost one, are:

half-cycle 1′ : $L_3 \longrightarrow R_2$: $o - u - o - u - o - u$.

half-cycle $2'$: $i = 0$; $R_2 \longrightarrow L_3$: $u - o - u - o - (1,s)2u - o$.
half-cycle $3'$: $i = 0$; $L_3 \longrightarrow R_2$: $o - u - o - u - 2o - u$.
half-cycle $4'$: $i \leq 1$; $R_2 \longrightarrow L_3$: $u - o - u - (1,s)2o - 2u - o$.
half-cycle $5'$: $i \leq 1$; $L_3 \longrightarrow R_2$: $o - u - o - 2u - 2o - u$.
half-cycle $6'$: $i \leq 2$; $R_2 \longrightarrow L_3$: $u - o - (1,s)2u - 2o - 2u - o$.
half-cycle $7'$: $i \leq 2$; $L_3 \longrightarrow R_2$: $o - u - 2o - 2u - 2o - u$.
half-cycle $8'$: $i \leq 3$; $R_2 \longrightarrow L_3$: $u - (1,s)2o - 2u - 2o - 2u - o$.
half-cycle $9'$: $i \leq 3$; $L_3 \longrightarrow R_2$: $o - 2u - 2o - 2u - 2o - u$.
half-cycle $10'$: $i \leq 4$; $R_2 \longrightarrow L_3$: $(1,s)2u - 2o - 2u - 2o - 2u - o$.

Then we braid the half-cycles $1''$ to $10''$ of the $p/b = 6/5$ over-under coded Regular Knot between the bight-boundaries L_2 and R_3 as depicted in Fig. 940. Its half-cycle braiding algorithms, read from the lowermost algorithm diagram, are:

half-cycle $1''$: $L_2 \longrightarrow R_3$: $o - 2u - 2o - 2u - 2o - 2u$.
half-cycle $2''$: $i = 0$; $R_3 \longrightarrow L_2$: $2u - 2o - 2u - 2o - (2,s)3u - o$.
half-cycle $3''$: $i = 0$; $L_2 \longrightarrow R_3$: $o - 2u - 2o - 2u - 3o - 2u$.
half-cycle $4''$: $i \leq 1$; $R_3 \longrightarrow L_2$: $2u - 2o - 2u - (2,s)3o - 3u - o$.
half-cycle $5''$: $i \leq 1$; $L_2 \longrightarrow R_3$: $o - 2u - 2o - 3u - 3o - 2u$.
half-cycle $6''$: $i \leq 2$; $R_3 \longrightarrow L_2$: $2u - 2o - (2,s)3u - 3o - 3u - o$.
half-cycle $7''$: $i \leq 2$; $L_2 \longrightarrow R_3$: $o - 2u - 3o - 3u - 3o - 2u$.
half-cycle $8''$: $i \leq 3$; $R_3 \longrightarrow L_2$: $2u - (2,s)3o - 3u - 3o - 3u - o$.
half-cycle $9''$: $i \leq 3$; $L_2 \longrightarrow R_3$: $o - 3u - 3o - 3u - 3o - 2u$.
half-cycle $10''$: $i \leq 4$; $R_3 \longrightarrow L_2$: $(2,s)3u - 3o - 3u - 3o - 3u - o$.

Next, retract the end of half-cycle 10 over six crossings and replace these by $(6,s)7u$. Then retract the end of half-cycle $10'$ over two crossings and replace these by $(2,s,2)5u$. Then retract the end of half-cycle $10''$ over one crossing and replace it by $(1,s,1)3u$.

Next, braid the Standing-End of half-cycle 1 as $3u - 3o - 4u$ from upper L_1 to lower R. Then braid the Standing-End of half-cycle $1'$ as $2o - 4u$ from upper L_3 to lower R. Then braid the Standing-End of half-cycle $1''$ above half-cycle $10''$ as $o - 10u$ from upper L_2 to lower R.

A knot similar in appearance to the Regular Nested Knot over the oval bead is depicted in Fig. 941 (left bight-edge towards thimble).

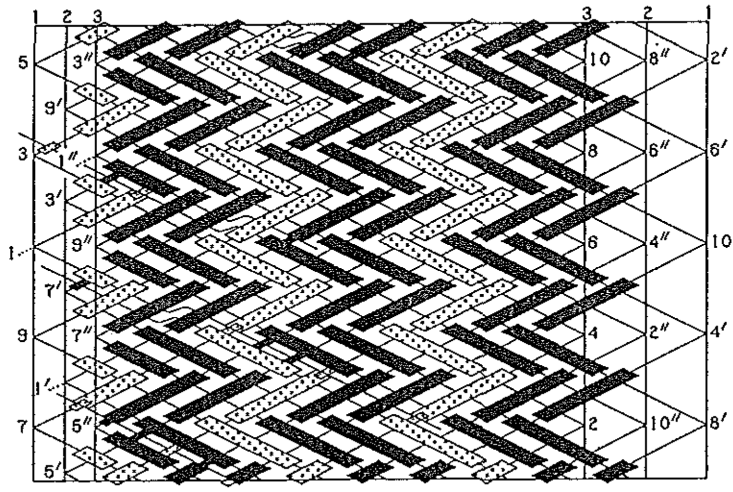


Fig. 941 — A similar looking knot to the one in Fig. 939.

The string-run specification of this Nested Knot is $(11/16/22)\{1_1 2_3 3_2 / 3_1 1_2 2_3\}15$. Fig. 941 depicts one of the ways in which this knot may be braided. Note that this knot is an interbraid of a $p/b = 7/5$ under-over coded Regular Knot with two $p/b = 6/5$ over-under coded Regular Knots.

We braid this Nested Knot first as depicted in Fig. 942 and after it has been completed in this manner, we partly rebraid the half-cycles $10, 10', 10''$ as shown in Fig. 941. Then we braid the Standing Ends of half-cycles $1, 1', 1''$ as shown in Fig. 941.

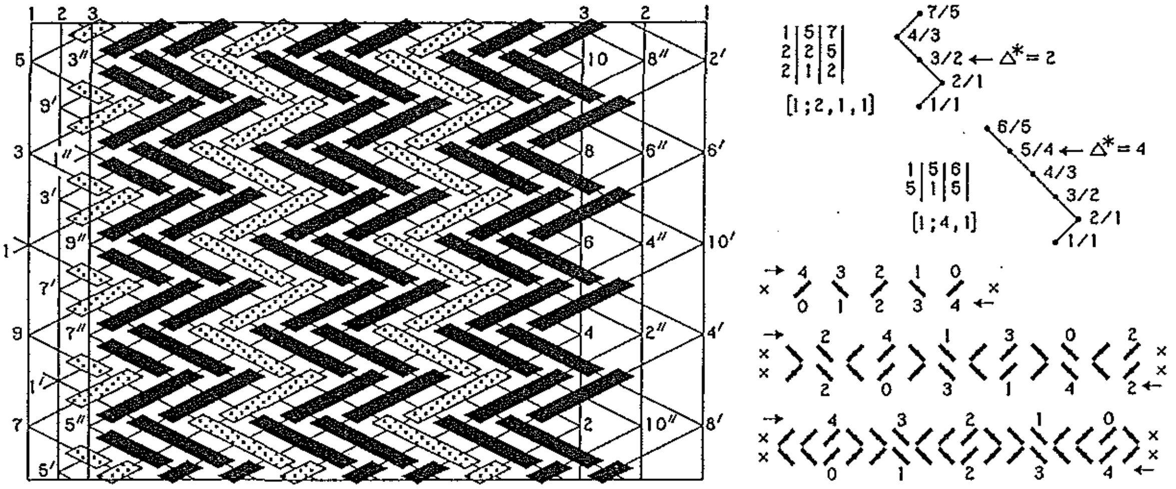


Fig. 942 — The initial braiding of the knot over oval bead adjacent to thimble.

Braiding begins with the $p/b = 6/5$ over-under coded Regular Knot between the bight-boundaries L_1 and R_3 as depicted in Fig. 942. Its half-cycle braiding algorithms, read from the uppermost algorithm diagram, are:

half-cycle 1 : $L_1 \longrightarrow R_3$: Free run.
half-cycle 2 : $i = 0$; $R_3 \longrightarrow L_1$: $(s)u$.
half-cycle 3 : $i = 0$; $L_1 \longrightarrow R_3$: o .
half-cycle 4 : $i \leq 1$; $R_3 \longrightarrow L_1$: $(s)o - u$.
half-cycle 5 : $i \leq 1$; $L_1 \longrightarrow R_3$: $u - o$.
half-cycle 6 : $i \leq 2$; $R_3 \longrightarrow L_1$: $(s)u - o - u$.
half-cycle 7 : $i \leq 2$; $L_1 \longrightarrow R_3$: $o - u - o$.
half-cycle 8 : $i \leq 3$; $R_3 \longrightarrow L_1$: $(s)o - u - o - u$.
half-cycle 9 : $i \leq 3$; $L_1 \longrightarrow R_3$: $u - o - u - o$.
half-cycle 10 : $i \leq 4$; $R_3 \longrightarrow L_1$: $(s)u - o - u - o - u$.

Next we braid the half-cycles $1'$ to $10'$ of the $p/b = 7/5$ under-over coded Regular Knot between the bight-boundaries L_2 and R_1 as depicted in Fig. 942. Its half-cycle braiding algorithms, read from the algorithm diagram immediately below the uppermost one, are:

half-cycle $1'$: $L_2 \longrightarrow R_1$: $u - o - u - o - u - o$.
half-cycle $2'$: $i = 0$; $R_1 \longrightarrow L_2$: $o - u - o - (1, s)2u - o - u$.
half-cycle $3'$: $i = 0$; $L_2 \longrightarrow R_1$: $u - o - u - o - 2u - o$.
half-cycle $4'$: $i \leq 1$; $R_1 \longrightarrow L_2$: $o - (1, s)2u - o - 2u - o - u$.
half-cycle $5'$: $i \leq 1$; $L_2 \longrightarrow R_1$: $u - o - 2u - o - 2u - o$.
half-cycle $6'$: $i \leq 2$; $R_1 \longrightarrow L_2$: $(s)u - o - 2u - o - 2u - (1, s)2o - u$.
half-cycle $7'$: $i \leq 2$; $L_2 \longrightarrow R_1$: $2u - o - 2u - o - 2u - 2o$.
half-cycle $8'$: $i \leq 3$; $R_1 \longrightarrow L_2$: $u - o - 2u - (1, s)2o - 2u - 2o - u$.
half-cycle $9'$: $i \leq 3$; $L_2 \longrightarrow R_1$: $2u - o - 2u - 2o - 2u - 2o$.
half-cycle $10'$: $i \leq 4$; $R_1 \longrightarrow L_2$: $u - (1, s)2o - 2u - 2o - 2u - 2o - u$.

Then we braid the half-cycles $1''$ to $10''$ of the $p/b = 6/5$ over-under coded Regular

Knot between the bight-boundaries L_3 and R_2 as depicted in Fig. 942. Its half-cycle braiding algorithms, read from the lowermost algorithm diagram, are:

half-cycle $1''$: $L_3 \longrightarrow R_2$: $2o-2u-2o-2u-2o-u$.
half-cycle $2''$: $i=0$; $R_2 \longrightarrow L_3$: $u-2o-2u-2o-(2,s)3u-2o$.
half-cycle $3''$: $i=0$; $L_3 \longrightarrow R_2$: $2o-2u-2o-2u-3o-u$.
half-cycle $4''$: $i \leq 1$; $R_2 \longrightarrow L_3$: $u-2o-2u-(2,s)3o-3u-2o$.
half-cycle $5''$: $i \leq 1$; $L_3 \longrightarrow R_2$: $2o-2u-2o-3u-3o-u$.
half-cycle $6''$: $i \leq 2$; $R_2 \longrightarrow L_3$: $u-2o-(2,s)3u-3o-3u-2o$.
half-cycle $7''$: $i \leq 2$; $L_3 \longrightarrow R_2$: $2o-2u-3o-3u-3o-u$.
half-cycle $8''$: $i \leq 3$; $R_2 \longrightarrow L_3$: $u-(2,s)3o-3u-3o-3u-2o$.
half-cycle $9''$: $i \leq 3$; $L_3 \longrightarrow R_2$: $2o-3u-3o-3u-3o-u$.
half-cycle $10''$: $i \leq 4$; $R_2 \longrightarrow L_3$: $(1,s)2u-3o-3u-3o-3u-2o$.

Next, retract the end of half-cycle 10 over one crossing and replace this by $(1,s)2u$. Then retract the end of half-cycle $10'$ over five crossings and replace these by $(5,s)6u$. Then retract the end of half-cycle $10''$ over two crossing and replace it by $(2,s,1)4u$.

Next, braid the Standing-End of half-cycle 1 as $o-10u$ from upper L_1 to lower R . Then braid the Standing-End of half-cycle $1'$ as $2u-3o-4u$ from upper L_2 to lower R . Then braid the Standing-End of half-cycle $1''$ above half-cycle $10''$ as $2o-4u$ from upper L_3 to lower R .

A round bead with a diameter of 24 mm. is placed at the end of the stem in a similar way as was done for the key-hangers No. 2 and No. 3. The nominal grid-diagram of the knot over this round bead at the end of the stem is depicted in Fig. 943 (left bight-edge towards thimble). Note that the knot depicted by the lower grid-diagram with its string-run specification $(2422/15/2242)\{1_1 5_6 4_5 3_4 5_3 2_2/4_1 5_2 1_3 2_4 5_5 3_6\}24$ is the mirror-image of the knot depicted by the upper grid-diagram with its string-run specification $(2422/15/2242)\{1_1 5_6 4_5 3_4 5_3 2_2/2_1 5_2 3_3 4_4 5_5 1_6\}24$.

We first braid these knots as depicted by the grid-diagrams in Fig. 944 (the upper knot in Fig. 943 is braided as shown in the upper grid-diagram in Fig. 944, and the lower knot in Fig. 943 is braided as shown in the lower grid-diagram in Fig. 944). Finally we work the ends of the strings away as shown in Fig. 945 (for the upper knot in Fig. 944 the string ends are worked away as shown in the upper grid-diagram in Fig. 945, and for the lower knot in Fig. 944 the string ends are worked away as shown in the lower grid-diagram in Fig. 945).

The nominal grid-diagram of the foundation knot in the upper nominal grid-diagram in Fig. 943 is depicted by the upper grid-diagram in Fig. 946 (string-run specification $(222/12/222)\{1432/2341\}16$). First we braid this foundation knot as shown by the lower grid-diagram in Fig. 946 (its associated half-cycle pattern is shown below it; refer to pp. 1203-1204 for the associated half-cycle tables and half-cycle braiding algorithms).

The nominal grid-diagram of the foundation knot in the lower nominal grid-diagram in Fig. 943 is depicted by the upper grid-diagram in Fig. 947 (string-run specification $(222/12/222)\{1432/4123\}16$). First we braid this foundation knot as shown by the lower grid-diagram in Fig. 947 (its associated half-cycle pattern is shown below it; refer to pp. 1204-1205 for the associated half-cycle tables and half-cycle braiding algorithms).

The interbraid for the upper and lower knots in Fig. 943 (half-cycles $1'$ - $16'$ in the upper and lower grid-diagrams in Fig. 944) is a $p/b = 5/8$ over-under coded Regular Knot. Its string ends in the upper and lower grid-diagrams in Fig. 945 are worked away identically. For its algorithm diagram and half-cycle braiding algorithms refer to pp. 1205-1206.

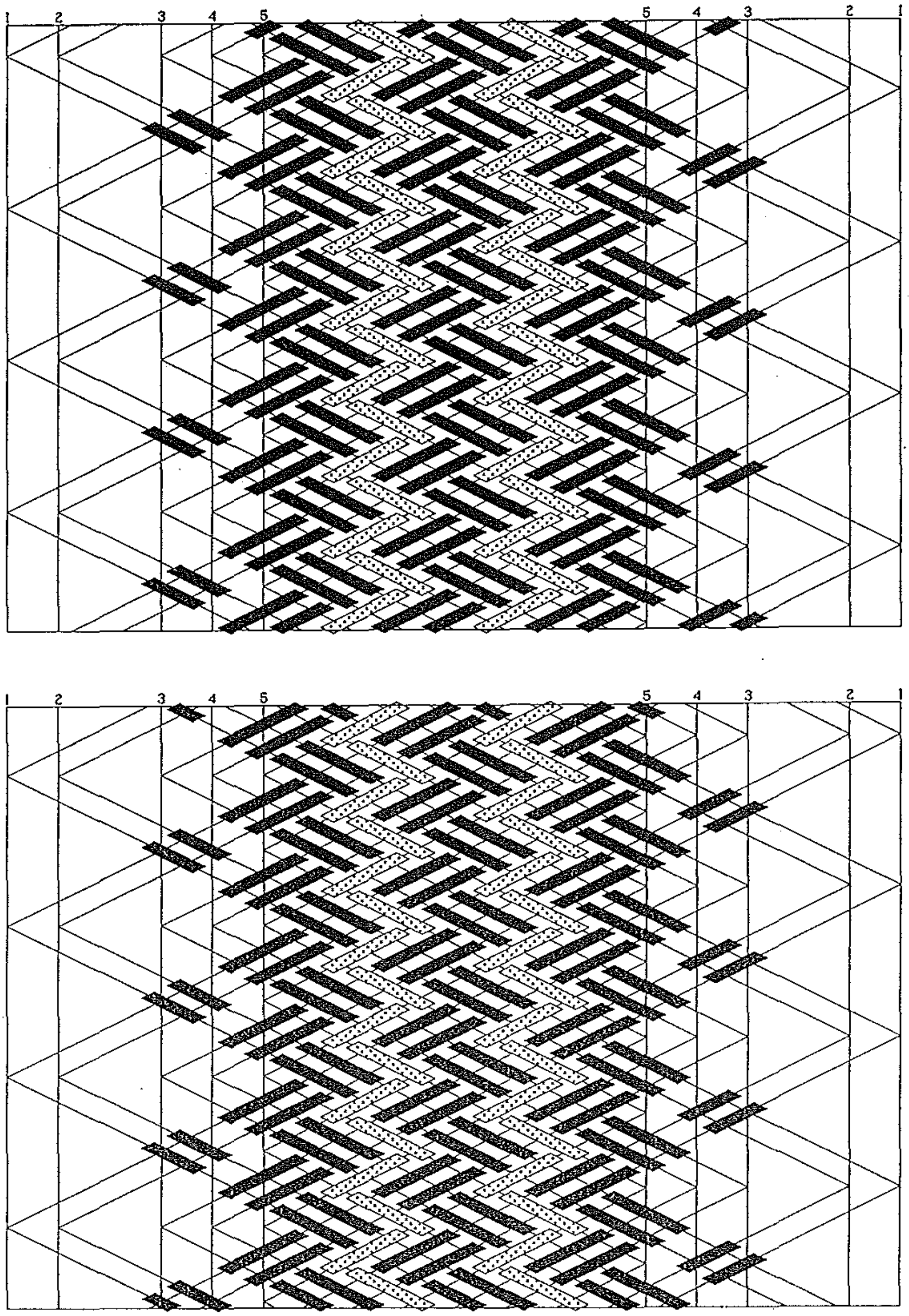


Fig. 943 — The knot over the round bead at the end of the stem.

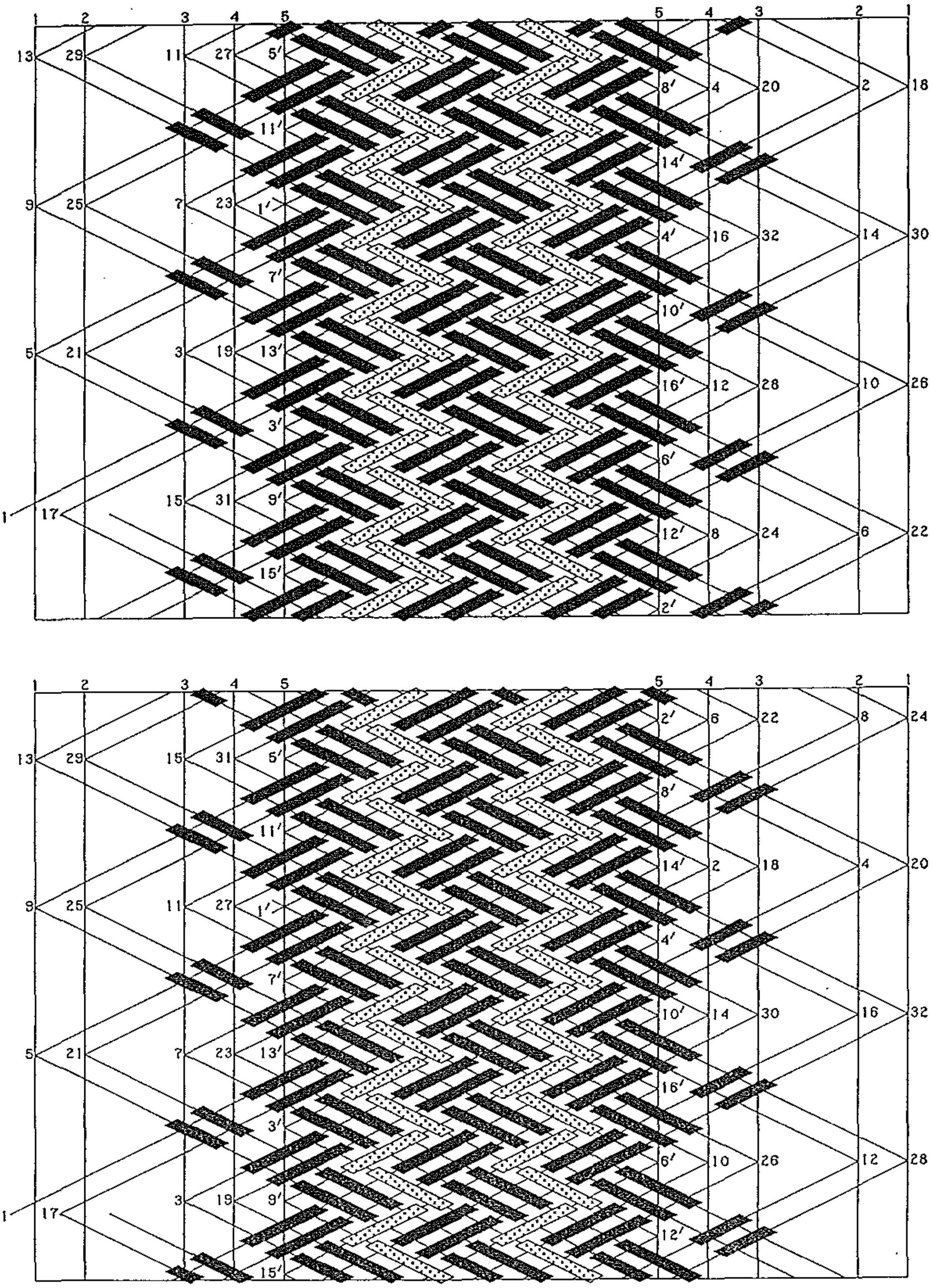


Fig. 944 — The knot over the round bead at the end of the stem.

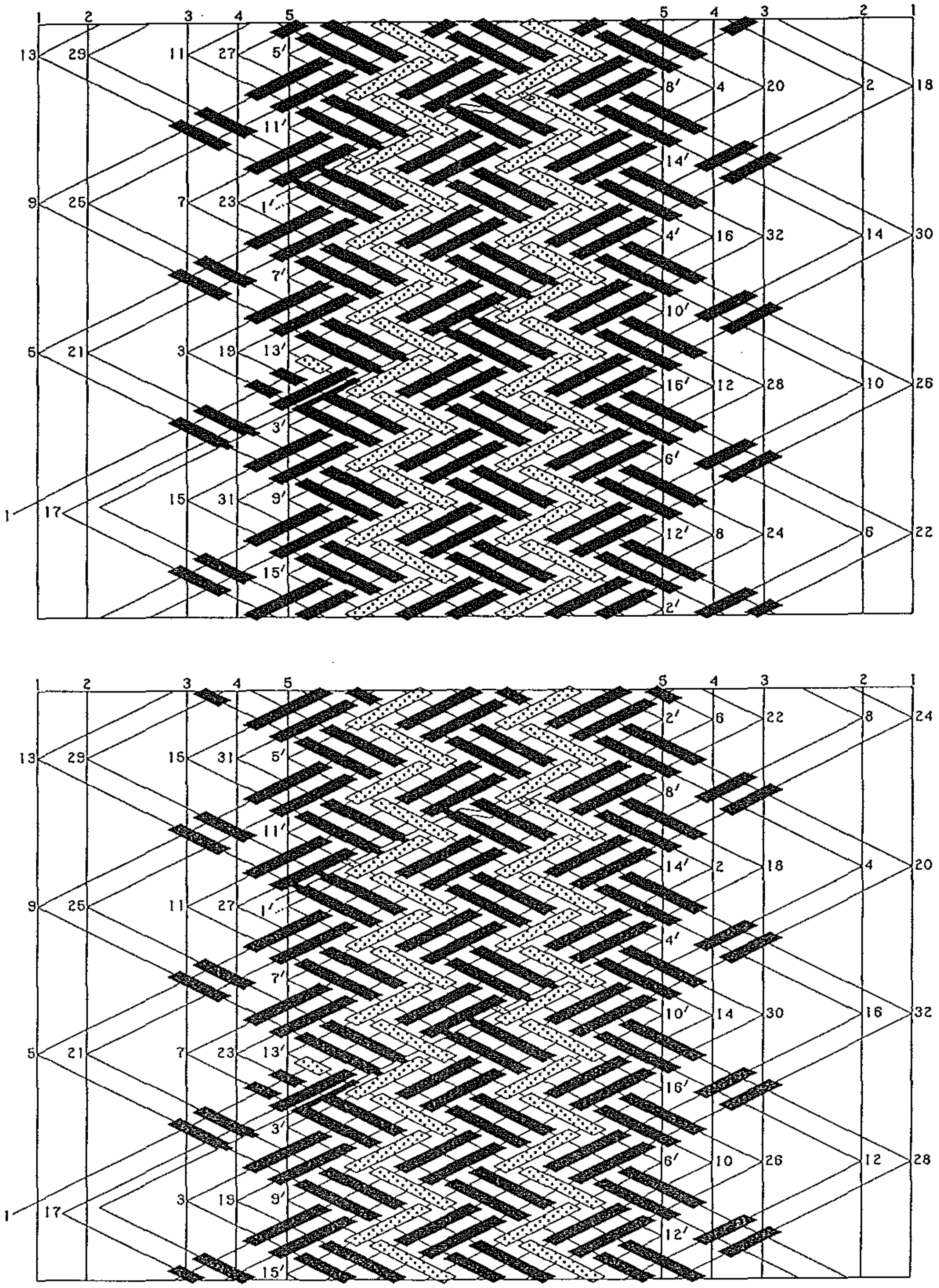
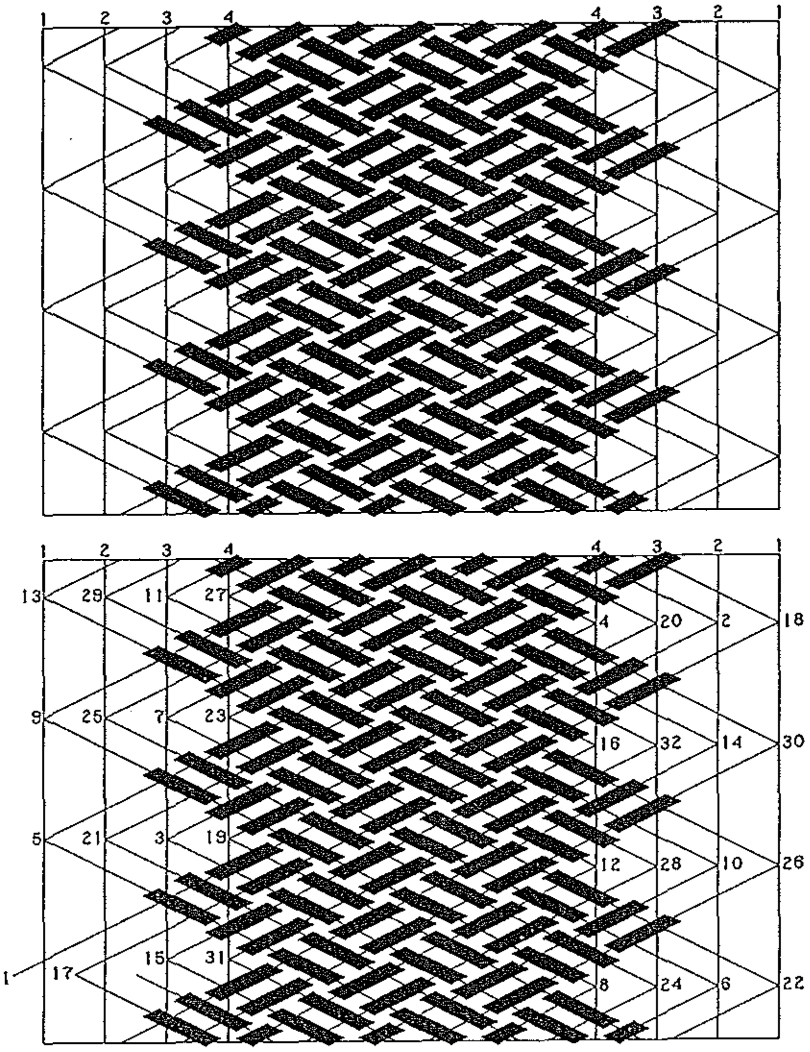
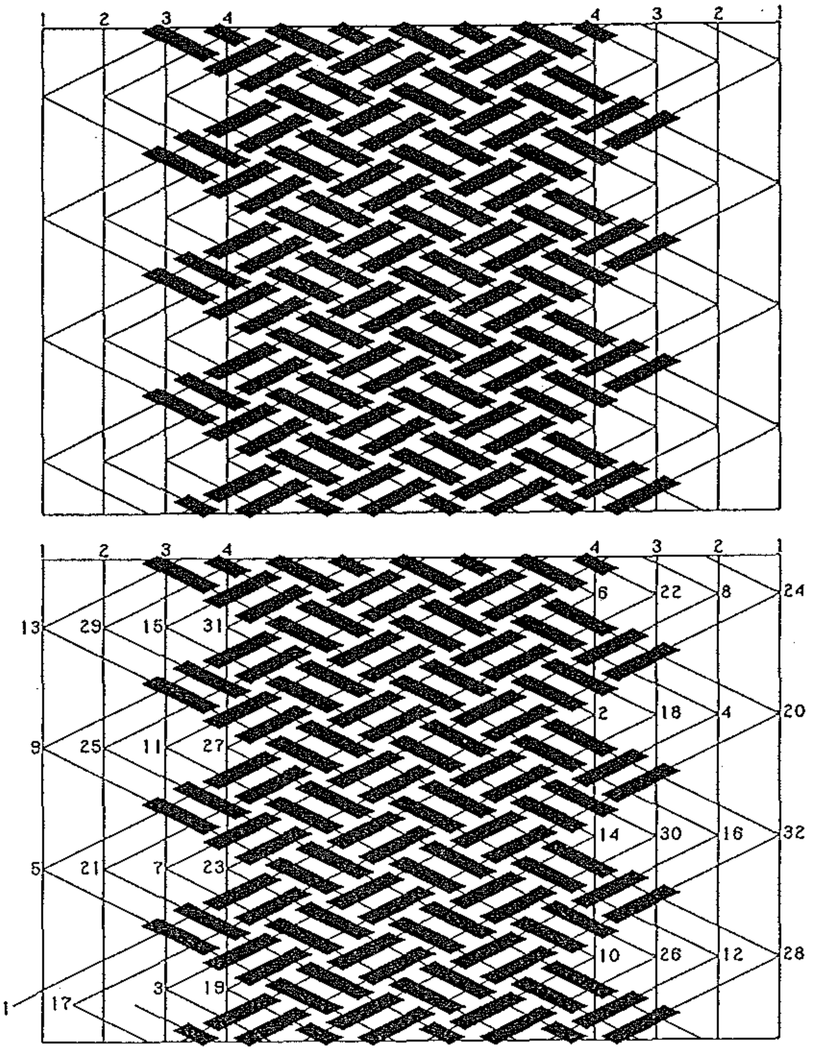


Fig. 945 — The knot over the round bead at the end of the stem.



BIGHT-BOUNDARIES →	1	2	3	4		4	3	2	1	← BIGHT-BOUNDARIES
	13	29	11	27	— 12 —	16	32	14	30	
	9	25	7	23	— 8 —	12	28	10	26	
	5	21	3	19	— 4 —	8	24	6	22	
	1	17	15	31	— 0 —	4	20	2	18	
CROSSINGS →	16	16	12	12		14	14	14	14	← CROSSINGS

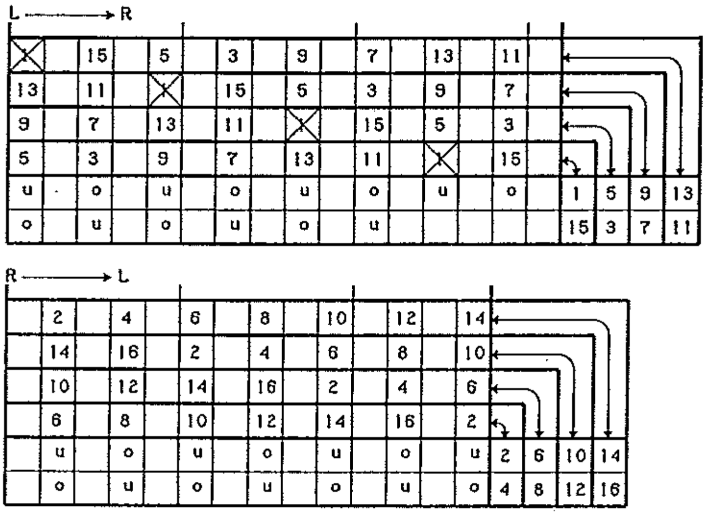
Fig. 946 — The knot over the round bead at the end of the stem.



BIGHT-BOUNDARIES →	1	2	3	4		4	3	2	1	← BIGHT-BOUNDARIES
	13	29	15	31	12	14	30	16	32	
	9	25	11	27	8	10	26	12	28	
	5	21	7	23	4	6	22	8	24	
	1	17	3	19	0	2	18	4	20	
CROSSINGS →	14	14	14	14		12	12	16	16	← CROSSINGS

Fig. 947 — The knot over the round bead at the end of the stem.

The half-cycle tables for half-cycles 1-16 in Fig. 946 are the two tables in Fig. 948.



L → R

☒		15		5		3		9		7		13		11					
13		11		☒		15		5		3		9		7					
9		7		13		11		☒		15		5		3					
5		3		9		7		13		11		☒		15					
u		o		u		o		u		o		u		o		1	5	9	13
o		u		o		u		o		u						15	3	7	11

R → L

	2		4		6		8		10		12		14				
	14		16		2		4		6		8		10				
	10		12		14		16		2		4		6				
	6		8		10		12		14		16		2				
	u		o		u		o		u		o		u	2	6	10	14
	o		u		o		u		o		u		o	4	8	12	16

Fig. 948 — Half-cycle tables for the half-cycles 1-16 in Fig. 946.

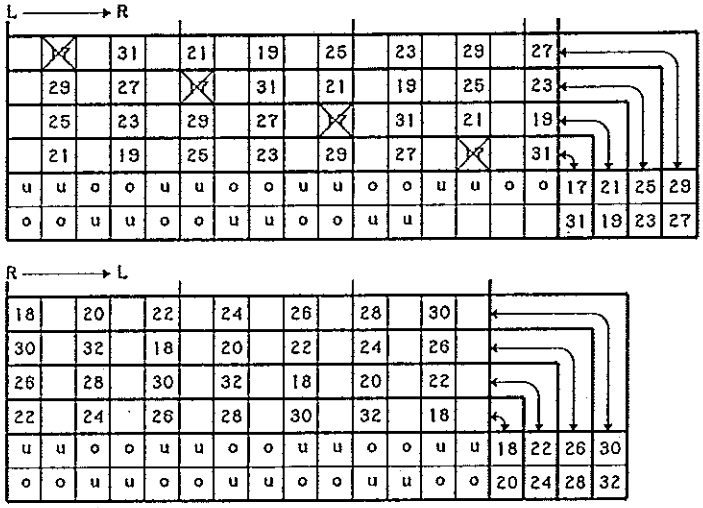
From these tables we read the following half-cycle braiding algorithms:

half-cycle 1. $L_1 \longrightarrow R_2$: Free run.
half-cycle 2. $R_2 \longrightarrow L_3$: $(s)u$.
half-cycle 3. $L_3 \longrightarrow R_4$: Free run.
half-cycle 4. $R_4 \longrightarrow L_1$: $(s)o$.
half-cycle 5. $L_1 \longrightarrow R_2$: $u - o$.
half-cycle 6. $R_2 \longrightarrow L_3$: $(s)u - o - u$.
half-cycle 7. $L_3 \longrightarrow R_4$: $o - u$.
half-cycle 8. $R_4 \longrightarrow L_1$: $(s)o - u - o$.
half-cycle 9. $L_1 \longrightarrow R_2$: $u - o - u - o$.
half-cycle 10. $R_2 \longrightarrow L_3$: $(s)u - o - u - o - u$.
half-cycle 11. $L_3 \longrightarrow R_4$: $o - u - o - u$.
half-cycle 12. $R_4 \longrightarrow L_1$: $(s)o - u - o - u - o$.
half-cycle 13. $L_1 \longrightarrow R_2$: $u - o - u - o - u - o$.
half-cycle 14. $R_2 \longrightarrow L_3$: $(s)u - o - u - o - u - o - u$.
half-cycle 15. $L_3 \longrightarrow R_4$: $o - u - o - u - o - u$.
half-cycle 16. $R_4 \longrightarrow L_{1}+$: $(s)o - u - o - u - o - u - o$.

The half-cycle tables for the half-cycles 17-32 in Fig. 946 are the two tables in Fig. 949. From these tables we read the following half-cycle braiding algorithms:

half-cycle 17. $L_{1}+ \longrightarrow R_1$: $u - o - u - o - u - o - u - o$.
half-cycle 18. $R_1 \longrightarrow L_4$: $u - o - u - o - u - o - (1,s)2u$.
half-cycle 19. $L_4 \longrightarrow R_3$: $o - u - o - u - o - u$.
half-cycle 20. $R_3 \longrightarrow L_2$: $o - u - o - u - o - u - (1,s)2o$.
half-cycle 21. $L_2 \longrightarrow R_1$: $u - o - u - o - u - o - 2u - 2o$.
half-cycle 22. $R_1 \longrightarrow L_4$: $u - o - u - o - (1,s)2u - 2o - 2u$.
half-cycle 23. $L_4 \longrightarrow R_3$: $o - u - o - u - 2o - 2u$.
half-cycle 24. $R_3 \longrightarrow L_2$: $o - u - o - u - (1,s)2o - 2u - 2o$.
half-cycle 25. $L_2 \longrightarrow R_1$: $u - o - u - o - 2u - 2o - 2u - 2o$.
half-cycle 26. $R_1 \longrightarrow L_4$: $u - o - (1,s)2u - 2o - 2u - 2o - 2u$.
half-cycle 27. $L_4 \longrightarrow R_3$: $o - u - 2o - 2u - 2o - 2u$.
half-cycle 28. $R_3 \longrightarrow L_2$: $o - u - (1,s)2o - 2u - 2o - 2u - 2o$.

half-cycle 29. $L_2 \longrightarrow R_1$: $u - o - 2u - 2o - 2u - 2o - 2u - 2o$.
half-cycle 30. $R_1 \longrightarrow L_4$: $(1, s)2u - 2o - 2u - 2o - 2u - 2o - 2u$.
half-cycle 31. $L_4 \longrightarrow R_3$: $2o - 2u - 2o - 2u - 2o - 2u$.
half-cycle 32. $R_3 \longrightarrow L_{2+}$: $(1, s)2o - 2u - 2o - 2u - 2o - 2u - 2o$.

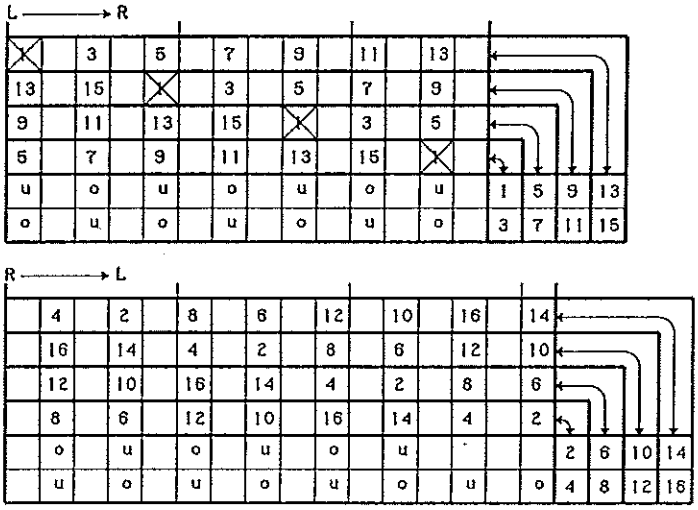


	~~17~~		31		21		19		25		23		29		27				
	29		27		~~17~~		31		21		19		25		23				
	25		23		29		27		~~17~~		31		21		19				
	21		19		25		23		29		27		~~17~~		31				
u	u	o	o	u	u	o	o	u	u	o	o	u	u	o	o	17	21	25	29
o	o	u	u	o	o	u	u	o	o	u	u					31	19	23	27

18		20		22		24		26		28		30					
30		32		18		20		22		24		26					
26		28		30		32		18		20		22					
22		24		26		28		30		32		18					
u	u	o	o	u	u	o	o	u	u	o	o	u	u	18	22	26	30
o	o	u	u	o	o	u	u	o	o	u	u	o	o	20	24	28	32

Fig. 949 — Half-cycle tables for the half-cycles 17-32 in Fig. 946.

The half-cycle tables for half-cycles 1-16 in Fig. 947 are the two tables in Fig. 950.



~~1~~		3		5		7		9		11		13					
13		15		~~1~~		3		5		7		9					
9		11		13		15		~~1~~		3		5					
5		7		9		11		13		15		~~1~~					
u		o		u		o		u		o		u		1	5	9	13
o		u		o		u		o		u		o		3	7	11	15

	4		2		8		6		12		10		16		14				
	16		14		4		2		8		6		12		10				
	12		10		16		14		4		2		8		6				
	8		6		12		10		16		14		4		2				
	o		u		o		u		o		u					2	6	10	14
	u		o		u		o		u		o		u		o	4	8	12	16

Fig. 950 — Half-cycle tables for the half-cycles 1-16 in Fig. 947.

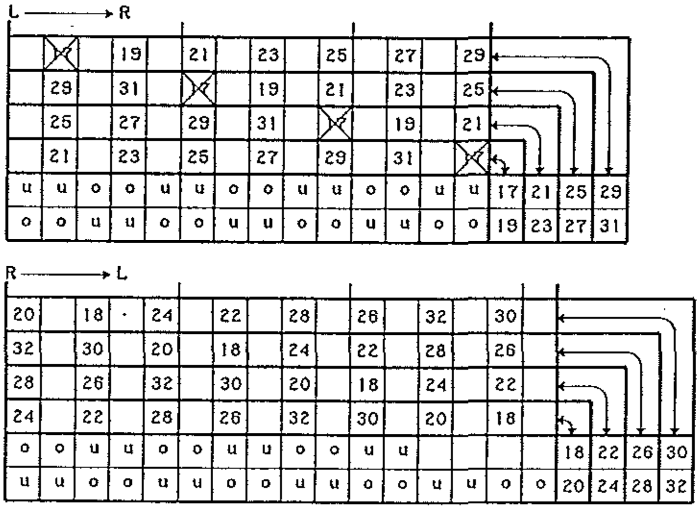
From these tables we read the following half-cycle braiding algorithms:

half-cycle 1. $L_1 \longrightarrow R_4$: Free run.
half-cycle 2. $R_4 \longrightarrow L_3$: Free run.
half-cycle 3. $L_3 \longrightarrow R_2$: Free run.
half-cycle 4. $R_2 \longrightarrow L_1$: $u - (s)o$.
half-cycle 5. $L_1 \longrightarrow R_4$: $o - u$.
half-cycle 6. $R_4 \longrightarrow L_3$: $o - (s)u$.
half-cycle 7. $L_3 \longrightarrow R_2$: $u - o$.
half-cycle 8. $R_2 \longrightarrow L_1$: $u - (s)o - u - o$.
half-cycle 9. $L_1 \longrightarrow R_4$: $o - u - o - u$.
half-cycle 10. $R_4 \longrightarrow L_3$: $o - (s)u - o - u$.
half-cycle 11. $L_3 \longrightarrow R_2$: $u - o - u - o$.

half-cycle 12. $R_2 \longrightarrow L_1$: $u-(s)o-u-o-u-o$.
half-cycle 13. $L_1 \longrightarrow R_4$: $o-u-o-u-o-u$.
half-cycle 14. $R_4 \longrightarrow L_3$: $o-(s)u-o-u-o-u$.
half-cycle 15. $L_3 \longrightarrow R_2$: $u-o-u-o-u-o$.
half-cycle 16. $R_2 \longrightarrow L_{1}+$: $u-(s)o-u-o-u-o-u-o$.

The half-cycle tables for the half-cycles 17-32 in Fig. 947 are the two tables in Fig. 951. From these tables we read the following half-cycle braiding algorithms:

half-cycle 17. $L_{1}+ \longrightarrow R_3$: $u-o-u-o-u-o-u$.
half-cycle 18. $R_3 \longrightarrow L_4$: $o-u-o-u-o-u$.
half-cycle 19. $L_4 \longrightarrow R_1$: $o-u-o-u-o-u-o$.
half-cycle 20. $R_1 \longrightarrow L_2$: $u-o-u-o-u-o-u-(1,s)2o$.
half-cycle 21. $L_2 \longrightarrow R_3$: $u-o-u-o-u-2o-2u$.
half-cycle 22. $R_3 \longrightarrow L_4$: $o-u-o-u-o-(1,s)2u$.
half-cycle 23. $L_4 \longrightarrow R_1$: $o-u-o-u-o-2u-2o$.
half-cycle 24. $R_1 \longrightarrow L_2$: $u-o-u-o-2u-(1,s)2o-2u-2o$.
half-cycle 25. $L_2 \longrightarrow R_3$: $u-o-u-2o-2u-2o-2u$.
half-cycle 26. $R_3 \longrightarrow L_4$: $o-u-2o-(1,s)2u-2o-2u$.
half-cycle 27. $L_4 \longrightarrow R_1$: $o-u-o-2u-2o-2u-2o$.
half-cycle 28. $R_1 \longrightarrow L_2$: $u-o-2u-(1,s)2o-2u-2o-2u-2o$.
half-cycle 29. $L_2 \longrightarrow R_3$: $u-2o-2u-2o-2u-2o-2u$.
half-cycle 30. $R_3 \longrightarrow L_4$: $2o-(1,s)2u-2o-2u-2o-2u$.
half-cycle 31. $L_4 \longrightarrow R_1$: $o-2u-2o-2u-2o-2u-2o$.
half-cycle 32. $R_1 \longrightarrow L_{2}+$: $2u-(1,s)2o-2u-2o-2u-2o-2u-2o$.



L ⟶ R

	☒		19		21		23		25		27		29				
	29		31		☒		19		21		23		25				
	25		27		29		31		☒		19		21				
	21		23		25		27		29		31		☒				
u	u	o	o	u	u	o	o	u	u	o	o	u	u	17	21	25	29
o	o	u	u	o	o	u	u	o	o	u	u	o	o	19	23	27	31

R ⟶ L

20		18		24		22		28		26		32		30			
32		30		20		18		24		22		28		26			
28		26		32		30		20		18		24		22			
24		22		28		26		32		30		20		18			
o	o	u	u	o	o	u	u	o	o	u	u					18	22	26	30
u	u	o	o	u	u	o	o	u	u	o	o	u	u	o	o	20	24	28	32

Fig. 951 — Half-cycle tables for the half-cycles 17-32 in Fig. 947.

The algorithm diagram for the $p/b = 5/8$ over-under coded Regular Knot interbraid for the foundation knots in Fig. 946 and Fig. 947 is shown in Fig. 952.

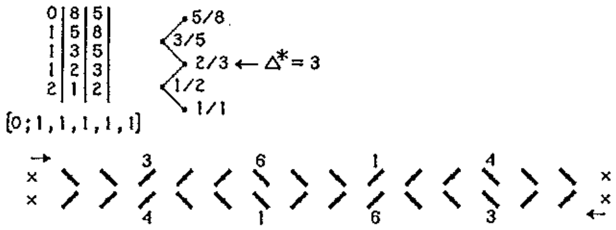


Fig. 952 — The algorithm diagram for the $p/b = 5/8$ over-under coded Regular Knot.

From this algorithm diagram we read the following half-cycle braiding algorithms:
half-cycle 1′ : $L_5 \longrightarrow R_5$: $2u - 2o - 2u - 2o - 2u$.
half-cycle 2′ : $i = 0$; $R_5 \longrightarrow L_5$: $2u - 2o - 2u - 2o - 2u$.
half-cycle 3′ : $i = 0$; $L_5 \longrightarrow R_5$: $2u - 2o - 2u - 2o - 2u$.
half-cycle 4′ : $i \leq 1$; $R_5 \longrightarrow L_5$: $2u - 2o - 2u - (s,2)3o - 2u$.
half-cycle 5′ : $i \leq 1$; $L_5 \longrightarrow R_5$: $2u - 2o - 2u - 3o - 2u$.
half-cycle 6′ : $i \leq 2$; $R_5 \longrightarrow L_5$: $2u - 2o - 2u - 3o - 2u$.
half-cycle 7′ : $i \leq 2$; $L_5 \longrightarrow R_5$: $2u - 2o - 2u - 3o - 2u$.
half-cycle 8′ : $i \leq 3$; $R_5 \longrightarrow L_5$: $2u - (s,2)3o - 2u - 3o - 2u$.
half-cycle 9′ : $i \leq 3$; $L_5 \longrightarrow R_5$: $2u - 3o - 2u - 3o - 2u$.
half-cycle 10′ : $i \leq 4$; $R_5 \longrightarrow L_5$: $2u - 3o - 2u - 3o - (s,2)3u$.
half-cycle 11′ : $i \leq 4$; $L_5 \longrightarrow R_5$: $2u - 3o - 2u - 3o - 3u$.
half-cycle 12′ : $i \leq 5$; $R_5 \longrightarrow L_5$: $2u - 3o - 2u - 3o - 3u$.
half-cycle 13′ : $i \leq 5$; $L_5 \longrightarrow R_5$: $2u - 3o - 2u - 3o - 3u$.
half-cycle 14′ : $i \leq 6$; $R_5 \longrightarrow L_5$: $2u - 3o - (s,2)3u - 3o - 3u$.
half-cycle 15′ : $i \leq 6$; $L_5 \longrightarrow R_5$: $2u - 3o - 3u - 3o - 3u$.
half-cycle 16′ : $i \leq 7$; $R_5 \longrightarrow L_5$: $2u - 3o - 3u - 3o - 3u$.

Next we work the string ends away:

Retract the Standing End of half-cycle 1 over 5 crossings and replace these first 5 crossings with $5u$ (see Figs. 944 & 945). Next braid the end of half-cycle 32 from lower L_{2+} to upper right: $2u - 3o - 9u$ (see Figs. 944 & 945).

Then retract the Standing End of half-cycle 1′ over 5 crossings and replace these first 5 crossings with $5u$ (see Figs. 944 & 945). Next braid the end of half-cycle 16′ from lower L_5 to upper right (immediately below half-cycle 1): $2u - 3o - 4u$ (see Figs. 944 & 945).

Note that the nominal grid-diagram of the foundation knot in Fig. 946 with $x = 12$ is similar to the nominal grid-diagram with $x = 16$ in Fig. 874 (see *The Braider*, Issue No. 48, pg. 1129).

The nominal grid-diagrams in Fig. 953 and Fig. 954 show some other interbraids on the nominal grid-diagram of the foundation knot in Fig. 946, while the nominal grid-diagrams in Fig. 955 show some other interbraids on the nominal grid-diagram of the knot in Fig. 898 (see *The Braider*, Issue No. 48, pg. 1142).

The string-run specifications for the nominal grid-diagrams in Fig. 953 are:
Upper grid-diagram: $(2411/17/2242)\{1_1 4_3 5_5 3_4 4_6 2_2/2_1 5_2 3_3 4_4 5_5 1_6\}24$,
with foundation knot $(222/12/222)\{1432/2341\}16$.
Lower grid-diagram: $(2422/17/1142)\{1_1 5_6 4_5 3_4 5_3 2_2/2_1 4_2 3_3 5_4 4_5 1_6\}24$,
with foundation knot $(222/12/222)\{1432/2341\}16$.

The string-run specifications for the nominal grid-diagrams in Fig. 954 are:
Upper grid-diagram: $(2222/17/2242)\{1_1 3_6 5_5 4_4 3_3 2_2/2_1 5_2 3_3 4_4 5_5 1_6\}24$,
with foundation knot $(222/12/222)\{1432/2341\}16$.
Lower grid-diagram: $(2422/17/2222)\{1_1 5_6 4_5 3_4 5_3 2_2/2_1 3_2 4_3 5_4 3_5 1_6\}24$,
with foundation knot $(222/12/222)\{1432/2341\}16$.

The string-run specifications for the nominal grid-diagrams in Fig. 955 are:
Upper grid-diagram: $(28/15/2242)\{1_1 3_3 2/2_1 5_2 3_3 4_4 5_5 1_6\}24$,
with foundation knot $(2/16/222)\{12/2341\}16$.
Lower grid-diagram: $(25/18/2242)\{1_1 3_3 2_2/2_1 5_2 3_3 4_4 5_5 1_6\}24$,
with foundation knot $(2/16/222)\{12/2341\}16$.

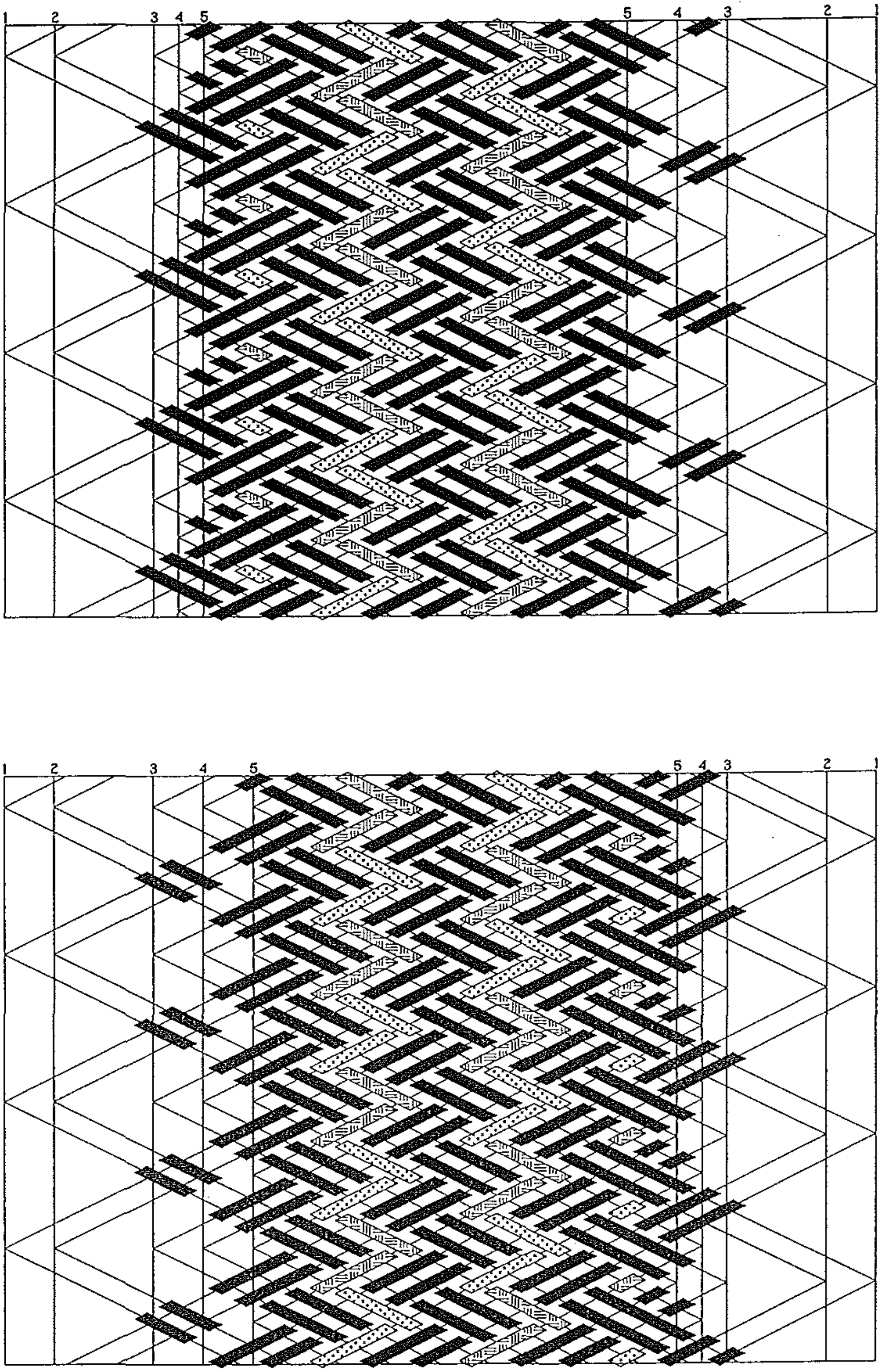


Fig. 953 — Refer to pg.1206.

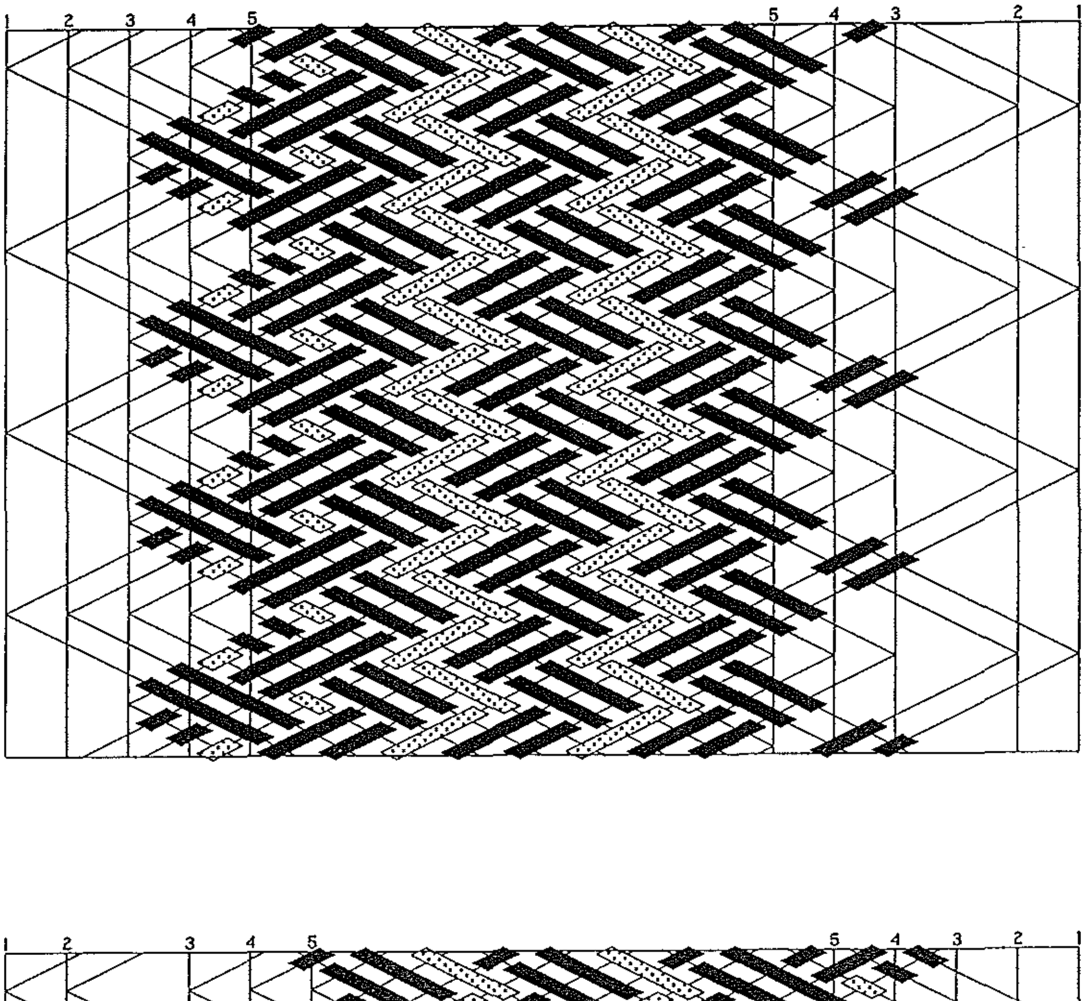


Fig. 954 — Refer to pg.1206.

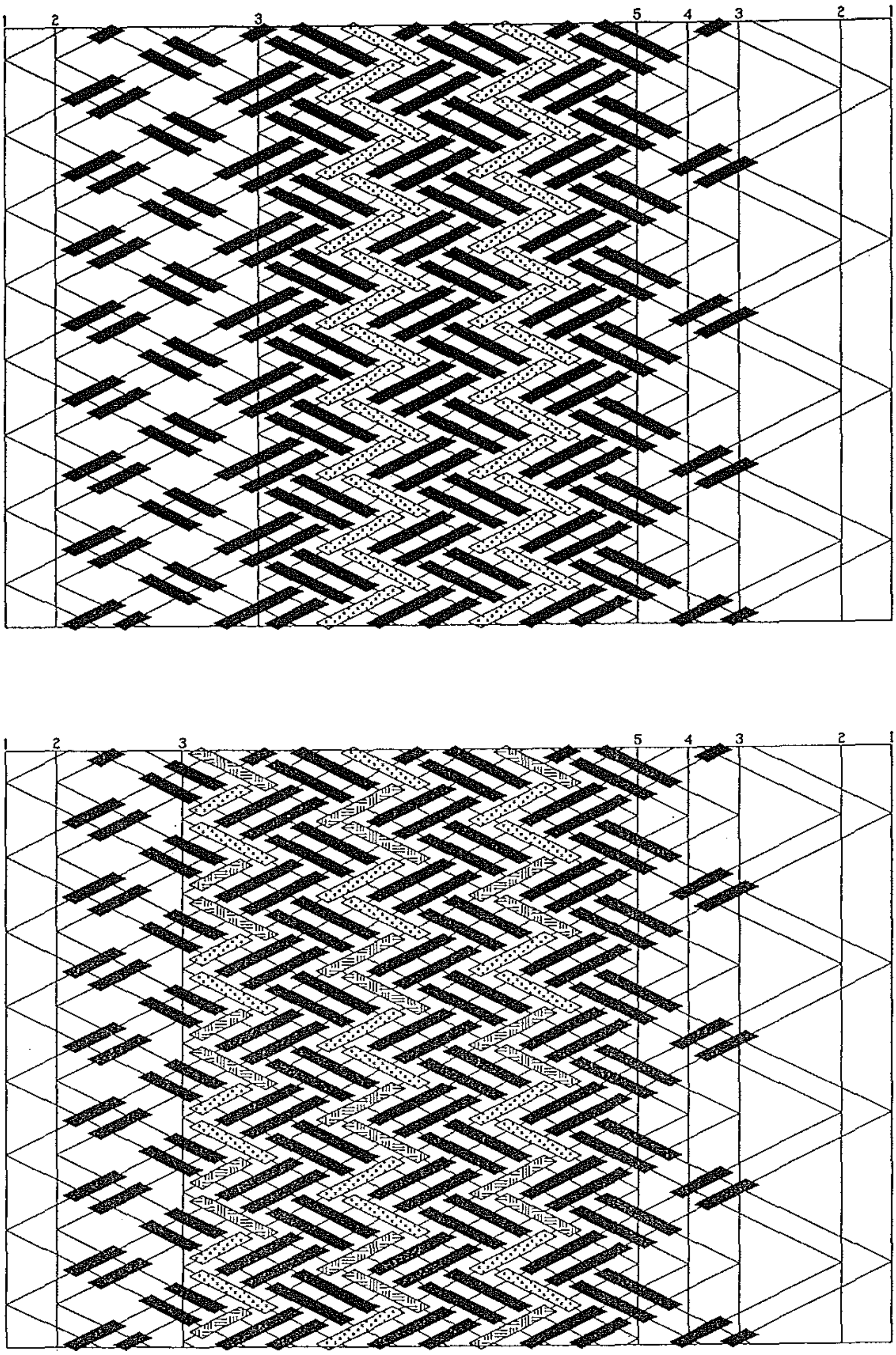


Fig. 955 — Refer to pg.1206.

Braid Design

Let's have, with the aid of a few examples, a little more general look at the braidforms we discussed in *The Braider*, Issues No. 49 and No. 50. Let's start with the round braid in Fig. 956 which we use in the design of the braid in Fig. 957.

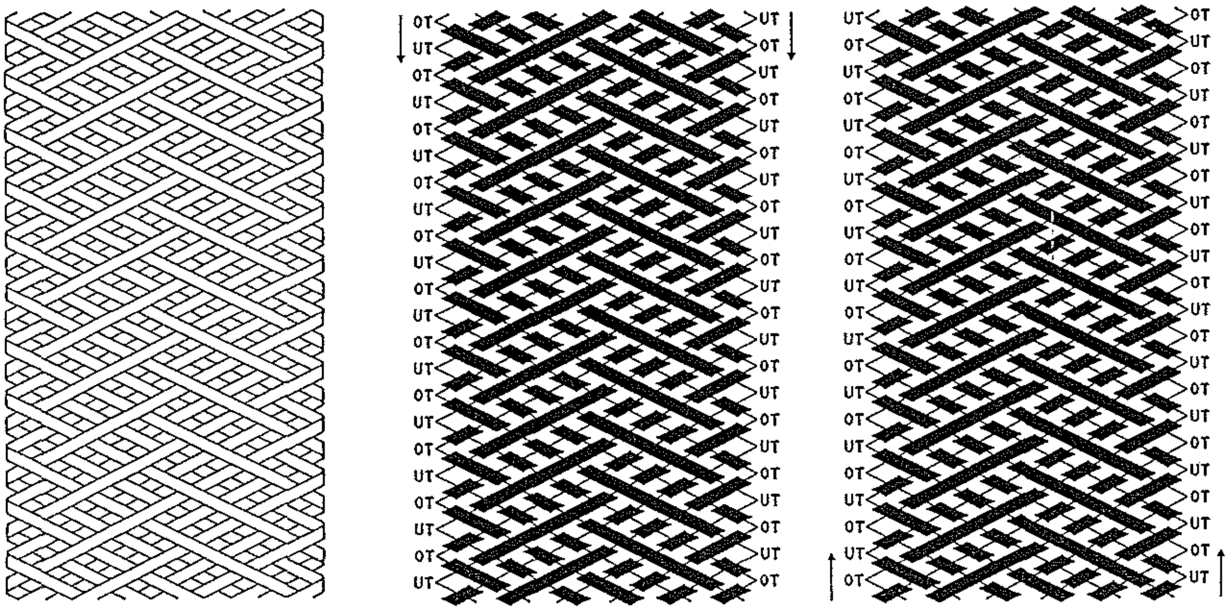


Fig. 956 — Round braid used in the design of Fig. 957.

Its half-cycle braiding algorithms are read from the algorithm diagrams in Fig. 957:

half-cycle 1: Free run.
half-cycle 2: $i = 0$: OT — $(s)o$.
half-cycle 3: $i = 0$: u.
half-cycle 4: $i \leq 1$: OT — $(s,1)2o$.
half-cycle 5: $i \leq 1$: $o - u$.
half-cycle 6: $i \leq 2$: OT — $(s,2)3o - (s)u$.
half-cycle 7: $i \leq 2$: $u - o - 2u$.
half-cycle 8: $i \leq 3$: OT — $2o - (s)u - o - u$.
half-cycle 9: $i \leq 3$: $u - o - 3u$.
half-cycle 10: $i \leq 4$: OT — $(1,s,1)3o - u - o - u - (s)o$.
half-cycle 11: $i \leq 4$: $u - 2o - 4u$.
half-cycle 12: $i \leq 5$: OT — $3o - u - (s,1)2o - u - o$.
half-cycle 13: $i \leq 5$: $u - 2o - u - o - 3u$.
half-cycle 14: $i \leq 6$: OT — $2o - (s)u - o - u - 2o - u - o$.
half-cycle 15: $i \leq 6$: $u - o - u - o - u - o - 3u$.
half-cycle 16: $i \leq 7$: OT — $(s,2)3o - u - o - u - 2o - (s,1)2u - o$.
half-cycle 17: $i \leq 7$: $2u - o - u - o - u - o - 4u$.
half-cycle 18: $i \leq 8$: OT — $3o - u - (1,s)2o - u - 2o - 2u - o$.
half-cycle 19: $i \leq 8$: $2u - o - u - 2o - u - o - 4u$.
half-cycle 20: $i \leq 9$: OT — $(2,s,1)4o - u - 2o - u - 2o - 2u - (s,1)2o$.
half-cycle 21: $i \leq 9$: $2u - 2o - u - 2o - u - o - 5u$.
half-cycle 22: $i \leq 10$: OT — $4o - u - 2o - (1,s)2u - 2o - 2u - 2o$.
half-cycle 23: $i \leq 10$: $2u - 2o - u - 2o - 2u - o - 5u$.
half-cycle 24: $i \leq 11$: OT — $(4,s)5o - u - 2o - 2u - 2o - 2u - 2o$.

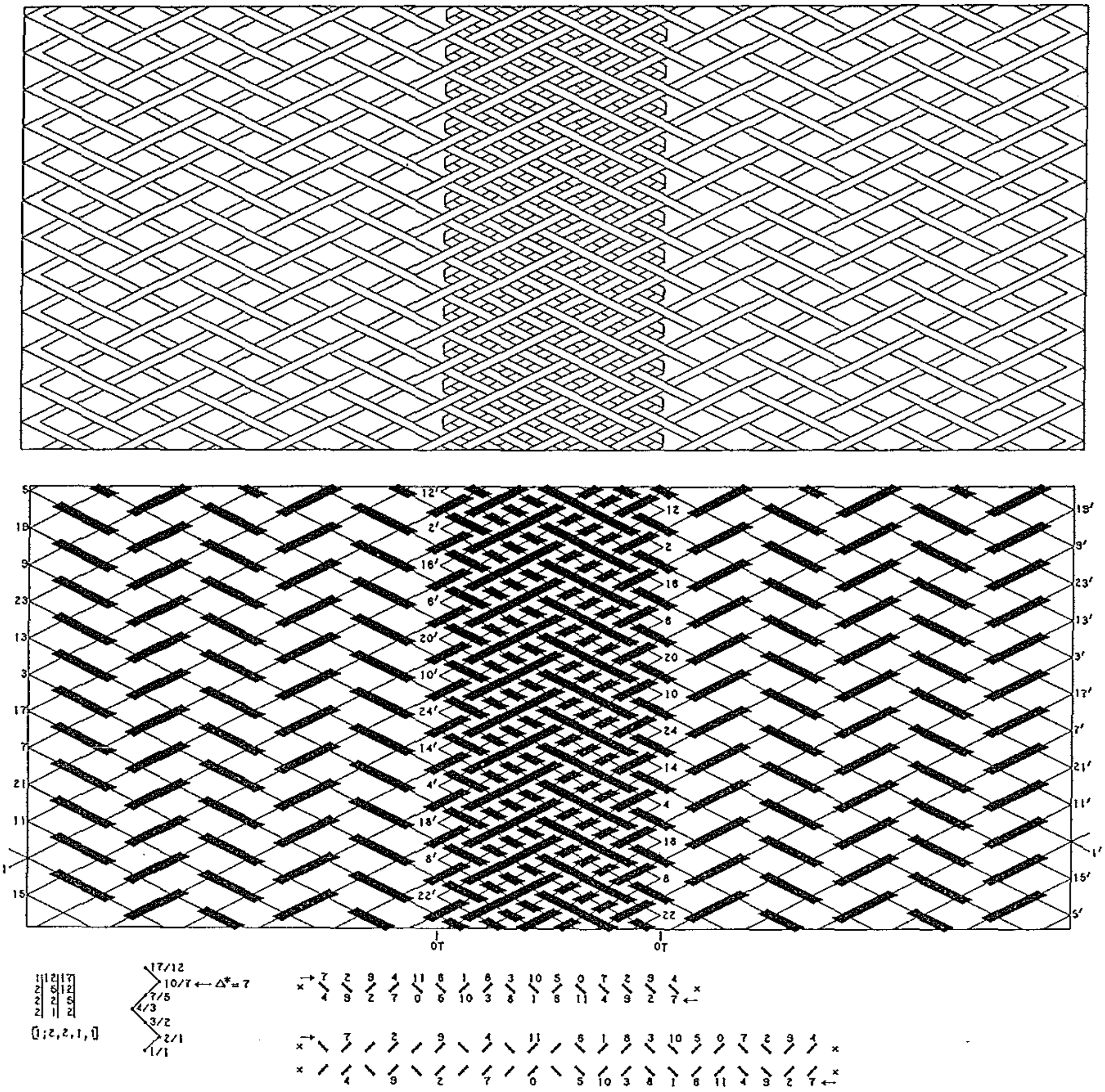


Fig. 957 — Interwoven bight-edges based on knot in Fig. 956.

half-cycle $1'$: $o - 2u - 2o - u$.
half-cycle $2'$: $i = 0$: OT — $u - 2o - 2u - (1,s)2o$.
half-cycle $3'$: $i = 0$: $o - 3u - 2o - u$.
half-cycle $4'$: $i \leq 1$: OT — $u - 2o - 2u - (1,s,1)3o$.
half-cycle $5'$: $i \leq 1$: $2o - 3u - 2o - u$.
half-cycle $6'$: $i \leq 2$: OT — $u - (1,s,1)3o - 2u - 3o - (s)u$.
half-cycle $7'$: $i \leq 2$: $u - 2o - 4u - 2o - u$.
half-cycle $8'$: $i \leq 3$: OT — $u - 3o - 2u - 2o - (s)u - o - u$.
half-cycle $9'$: $i \leq 3$: $u - o - u - o - 4u - 2o - u$.
half-cycle $10'$: $i \leq 4$: OT — $u - 3o - u - (s)o - u - 2o - u - o - u - (s)o$.
half-cycle $11'$: $i \leq 4$: $u - 2o - u - o - 4u - 2o - 2u$.
half-cycle $12'$: $i \leq 5$: OT — $u - 3o - u - o - u - 2o - u - (s,1)2o - u - o$.

half-cycle 13′: $i \leq 5$: $u - 2o - u - 2o - 4u - 2o - 2u$.
half-cycle 14′: $i \leq 6$: OT — $u - 3o - u - o - u - o - (s)u - o - u - 2o - u - o$.
half-cycle 15′: $i \leq 6$: $u - o - u - o - u - 2o - 4u - 2o - 2u$.
half-cycle 16′: $i \leq 7$: OT — $u - (s,3)4o - u - o - u - o - u - o - u - 2o - (s,1)2u - o$.
half-cycle 17′: $i \leq 7$: $2u - o - u - o - u - 2o - 5u - 2o - 2u$.
half-cycle 18′: $i \leq 8$: OT — $u - 4o - u - o - u - o - u - (1,s)2o - u - 2o - 2u - o$.
half-cycle 19′: $i \leq 8$: $2u - o - u - 2o - u - 2o - 5u - 2o - 2u$.
half-cycle 20′: $i \leq 9$: OT — $u - (4,s)5o - u - o - u - o - u - 2o - u - 2o - 2u - (s,1)2o$.
half-cycle 21′: $i \leq 9$: $2u - 2o - u - 2o - u - 2o - 5u - o - u - o - 2u$.
half-cycle 22′: $i \leq 10$: OT — $u - 5o - u - o - u - o - u - 2o - (1,s)2u - 2o - 2u - 2o$.
half-cycle 23′: $i \leq 10$: $2u - 2o - u - 2o - 2u - 2o - 5u - o - u - o - 2u$.
half-cycle 24′: $i \leq 11$: OT — $u - 5o - u - o - u - (s,1)2o - u - 2o - 2u - 2o - 2u - 2o$.

Using flat string of course, let's first braid this braid **with** the OT movements and after that again, but **without** the OT movements. Compare the two results. We see that there is little if any difference between these two knots apart from their surface texture[†] — the experienced braider who pays attention to detail will detect a very slight difference though, depending on the width/thickness ratio of the string. For the shape of the two knots we observe that the central 'overlaying' part of the interwoven knot components rises gently above their 'non-overlapping' parts.

Let's use the round braid in Fig. 956 again but rotated through 180° in Fig. 958. The half-cycle braiding algorithms for the half-cycles 1 - 24 are those on pg. 1210, while the half-cycle braiding algorithms for the half-cycles 1′ - 24′ are as follows:

half-cycle 1′: $u - 2o - 2u - o$.
half-cycle 2′: $i = 0$: OT — $o - 2u - 2o - u - (s)o$.
half-cycle 3′: $i = 0$: $2u - 2o - 2u - o$.
half-cycle 4′: $i \leq 1$: OT — $o - 2u - 2o - u - (s,1)2o$.
half-cycle 5′: $i \leq 1$: $o - 2u - 2o - 2u - o$.
half-cycle 6′: $i \leq 2$: OT — $o - u - (s)o - u - 2o - u - 2o - (s)u$.
half-cycle 7′: $i \leq 2$: $u - o - 2u - 2o - 3u - o$.
half-cycle 8′: $i \leq 3$: OT — $o - u - o - u - 2o - u - o - (s)u - o - u$.
half-cycle 9′: $i \leq 3$: $u - o - 3u - 2o - 3u - o$.
half-cycle 10′: $i \leq 4$: OT — $o - u - o - u - (1,s,1)3o - u - o - u - o - u - (s)o$.
half-cycle 11′: $i \leq 4$: $u - 2o - 3u - 2o - 4u - o$.
half-cycle 12′: $i \leq 5$: OT — $o - u - o - u - 3o - u - o - u - (s,1)2o - u - o$.

[†] String which has a different surface texture for their two parallel wide sides, the upper surface of half-cycles 1, 4, 5, 8, 9, 12, 13, 16, 17, 20, 21, 24 differs from the upper surface of half-cycles 2, 3, 6, 7, 10, 11, 14, 15, 18, 19, 22, 23.

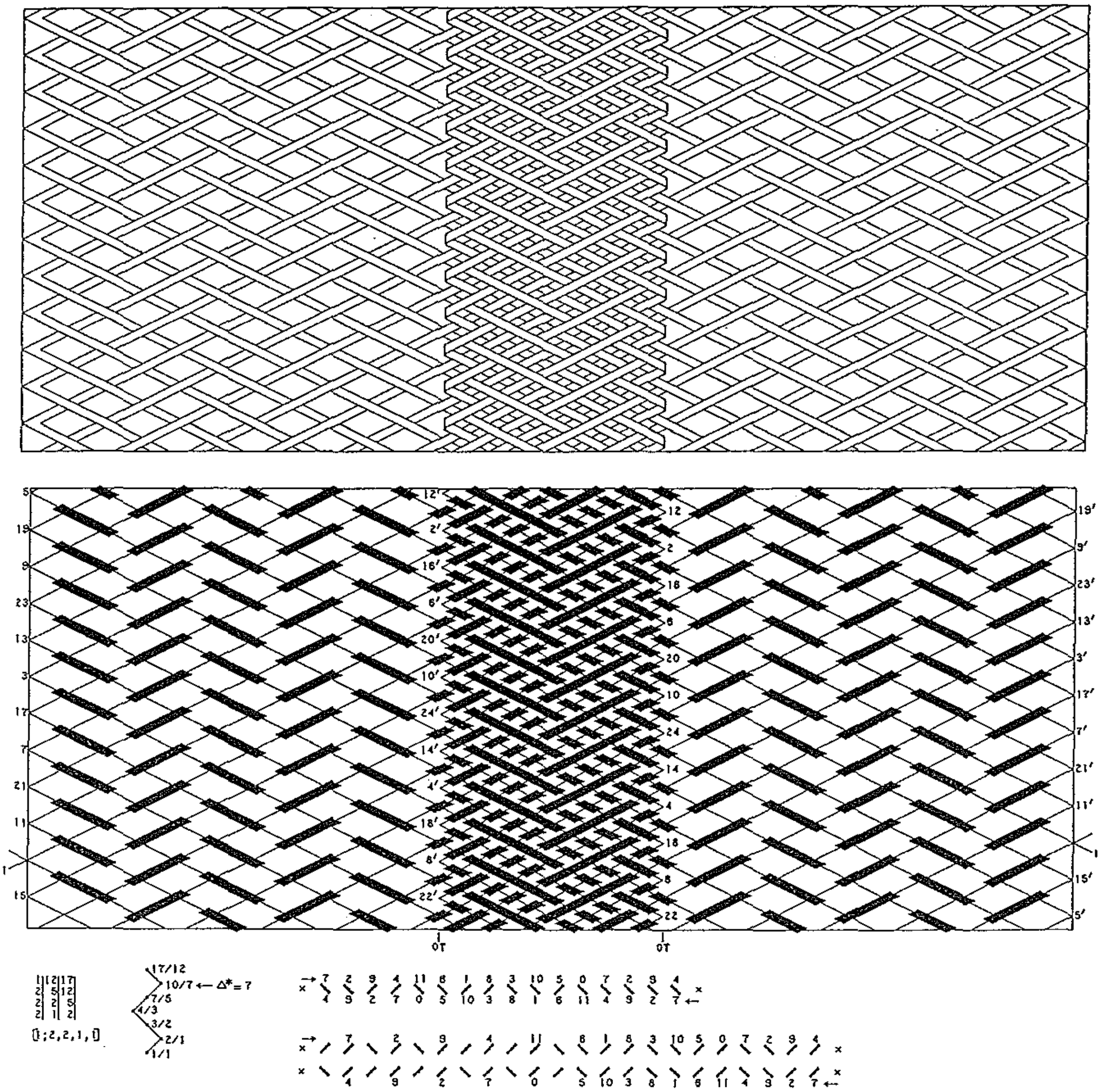


Fig. 958 — Interwoven bight-edges based on knot in Fig. 956 rotated 180°.

half-cycle 13′ : $i \leq 5$: $u - 2o - u - o - 2u - 2o - 4u - o$.

half-cycle 14′ : $i \leq 6$: OT — $o - u - o - u - 3o - (1,s)2u - o - u - 2o - u - o$.

half-cycle 15′ : $i \leq 6$: $u - o - u - o - u - o - 2u - 2o - 4u - o$.

half-cycle 16′ : $i \leq 7$: OT — $(1,s)2o - u - o - u - 3o - 2u - o - u - 2o - (s,1)2u - o$.

half-cycle 17′ : $i \leq 7$: $2u - o - u - o - u - o - 2u - o - u - o - 4u - o$.

half-cycle 18′ : $i \leq 8$: OT — $2o - u - o - u - 3o - 2u - (1,s)2o - u - 2o - 2u - o$.

half-cycle 19′ : $i \leq 8$: $2u - o - u - 2o - u - o - 2u - o - u - o - 4u - o$.

half-cycle 20′: $i \le 9$: OT — $2o - u - o - u - (s,3)4o - 2u - 2o - u - 2o-$
$2u - (s,1)2o$.
half-cycle 21′: $i \le 9$: $2u - 2o - u - 2o - u - o - 2u - o - u - o-$
$5u - o$.
half-cycle 22′: $i \le 10$: OT — $2o - u - o - u - 4o - 2u - 2o - (1,s)2u - 2o-$
$2u - 2o$.
half-cycle 23′: $i \le 10$: $2u - 2o - u - 2o - 2u - o - 2u - o - u - o-$
$5u - o$.
half-cycle 24′: $i \le 11$: OT — $2o - u - o - u - (4,s)5o - 2u - 2o - 2u - 2o-$
$2u - 2o$.

Let's with flat string first braid this braid **with** the OT movements and after that **without** the OT movements. Compare the two results. We see that the two knots differ greatly in the appearance of the bight-edges of the central 'overlaying' part of the interwoven knot components and that this part lies distinctly above the rest of the knot, more or less as if the central 'overlaying' part is a knot **over** a knot.

Let's now employ the round braid in Fig. 959 in the design of Fig. 960 (note that this round braid is identical to the round braid in Fig. 956).

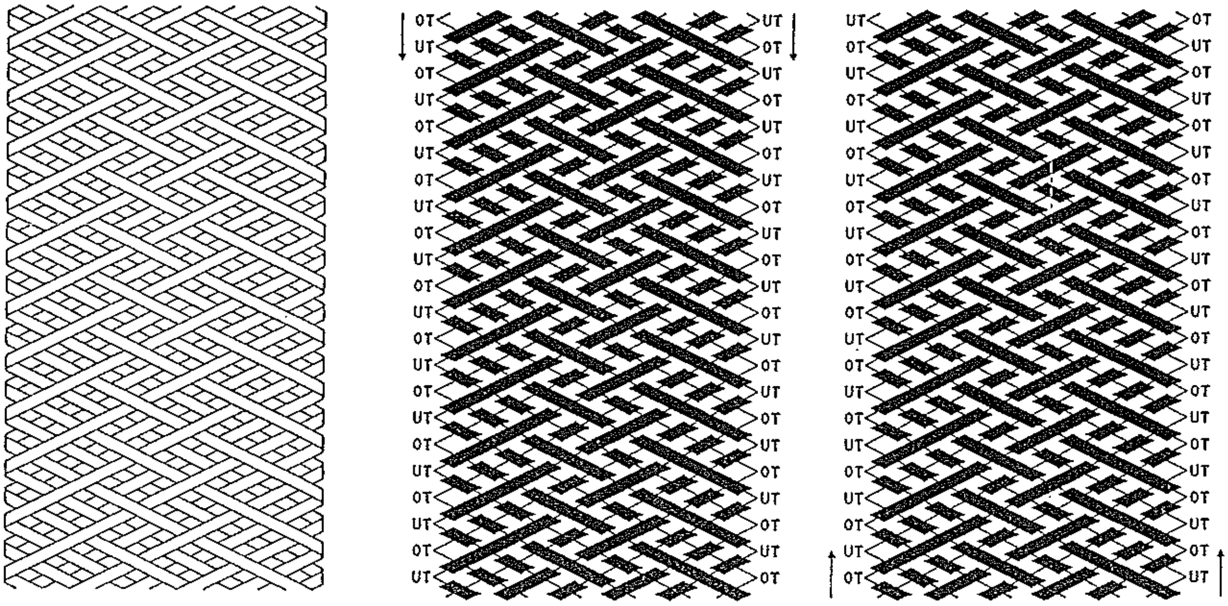


Fig. 959 — Round braid used in the design of Fig. 960.

The half-cycle braiding algorithms for the half-cycles 1 - 24 are those on pg. 1210 again, while the half-cycle braiding algorithms for the half-cycles 1′ - 24′ are as follows:

half-cycle 1′: $2u - o - u - 2o$.
half-cycle 2′: $i = 0$: OT — $2o - u - o - 2u - (s)o$.
half-cycle 3′: $i = 0$: $3u - o - u - 2o$.
half-cycle 4′: $i \le 1$: OT — $2o - u - o - 2u - (s,1)2o$.
half-cycle 5′: $i \le 1$: $o - 3u - o - u - 2o$.
half-cycle 6′: $i \le 2$: OT — $(2,s)3o - u - o - 2u - 2o - (s)u$.
half-cycle 7′: $i \le 2$: $u - o - 3u - o - 2u - 2o$.
half-cycle 8′: $i \le 3$: OT — $3o - u - o - 2u - o - (s)u - o - u$.
half-cycle 9′: $i \le 3$: $u - o - 4u - o - 2u - 2o$.
half-cycle 10′: $i \le 4$: OT — $3o - u - (1,s)2o - 2u - o - u - o - u - (s)o$.

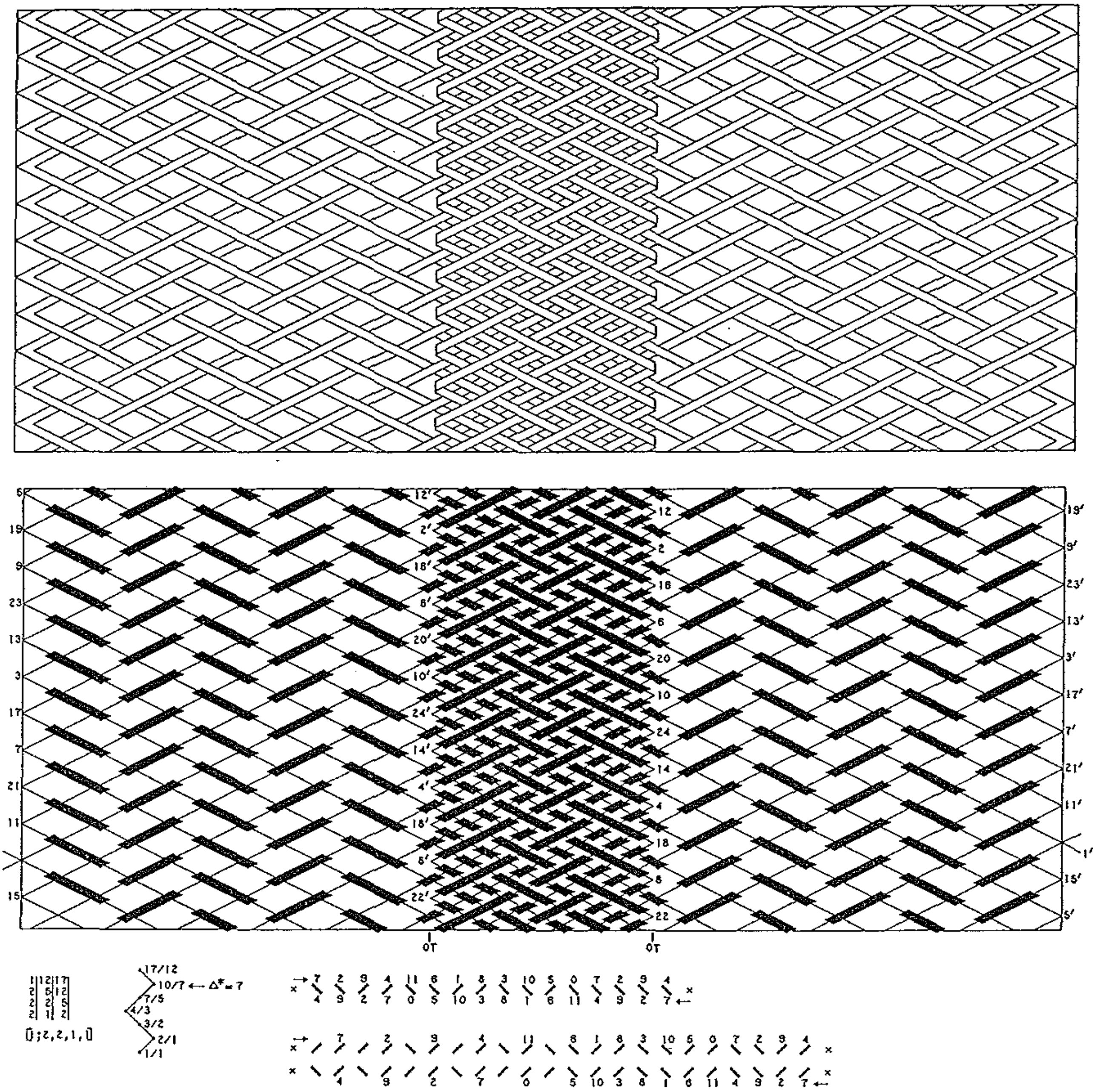


Fig. 960 — Interwoven bight-edges based on knot in Fig. 959.

half-cycle 11′ : $i \le 4$: $u - 2o - 4u - o - 2u - o - u - o$.
half-cycle 12′ : $i \le 5$: OT — $3o - u - 2o - 2u - o - u - (s,1)2o - u - o$.
half-cycle 13′ : $i \le 5$: $u - 2o - u - o - 3u - o - 2u - o - u - o$.
half-cycle 14′ : $i \le 6$: OT — $3o - u - 2o - (2,s)3u - o - u - 2o - u - o$.
half-cycle 15′ : $i \le 6$: $u - o - u - o - u - o - 3u - o - 2u - o - u - o$.
half-cycle 16′ : $i \le 7$: OT — $(1,s,2)4o - u - 2o - 3u - o - u - 2o-$
$(s,1)2u - o$.
half-cycle 17′ : $i \le 7$: $2u - o - u - o - u - o - 4u - o - 2u - o-$
$u - o$.
half-cycle 18′ : $i \le 8$: OT — $4o - u - 2o - 3u - (1,s)2o - u - 2o - 2u - o$.
half-cycle 19′ : $i \le 8$: $2u - o - u - 2o - u - o - 4u - o - 2u - o-$
$u - o$.

half-cycle 20′: $i \leq 9$: OT — $4o - u - (s,2)3o - 3u - 2o - u - 2o - 2u - (s,1)2o$.
half-cycle 21′: $i \leq 9$: $2u - 2o - u - 2o - u - o - 4u - o - 3u - o - u - o$.
half-cycle 22′: $i \leq 10$: OT — $4o - u - 3o - 3u - 2o - (1,s)2u - 2o - 2u - 2o$.
half-cycle 23′: $i \leq 10$: $2u - 2o - u - 2o - 2u - o - 4u - o - 3u - o - u - o$.
half-cycle 24′: $i \leq 11$: OT — $4o - u - 3o - u - (s)o - 2u - 2o - 2u - 2o - 2u - 2o$.

Let's with flat string first braid this braid **with** the OT movements and after that **without** the OT movements. Compare the two results. Apart from any surface texture, the appearance of the two knots is nearly the same; there is only a slight difference in the appearance of the bight-edges of the central 'overlaying' part of the interwoven knot components. Again as in the last case, the central 'overlaying' part of the interwoven knot components lies distinctly above their adjacent 'non-overlapping' parts, more or less as if the central 'overlaying' part is a knot **over** a knot. The 'overlaying' part of the interwoven knot components will always lie distinctly above their adjacent 'non-overlapping' parts when the interwoven part of the knot components has the essential coding shown in Fig. 961 whether or not the OT movements are being employed.

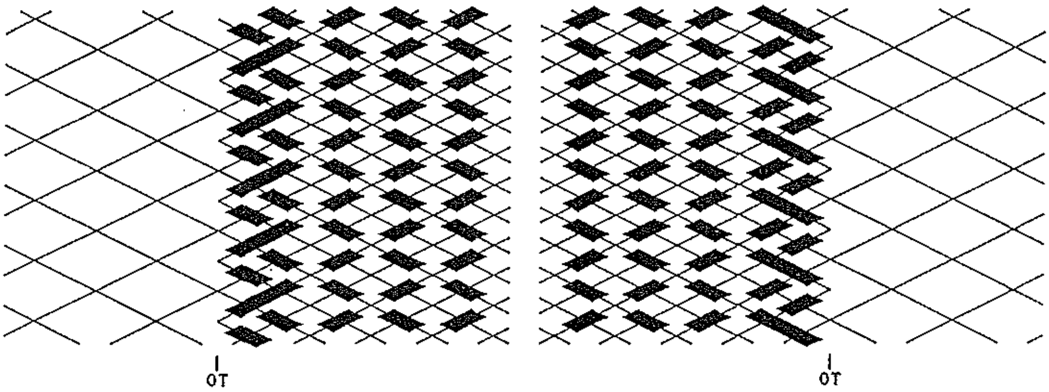


Fig. 961 — Upper central layer distinctly above the rest of the knot.

Whether or not the OT movements are being employed, the overlaying part of the knot does not lie at its edges distinctly above the rest of the knot when the essential coding of the interwoven part of the knot components is as shown in Fig. 962.

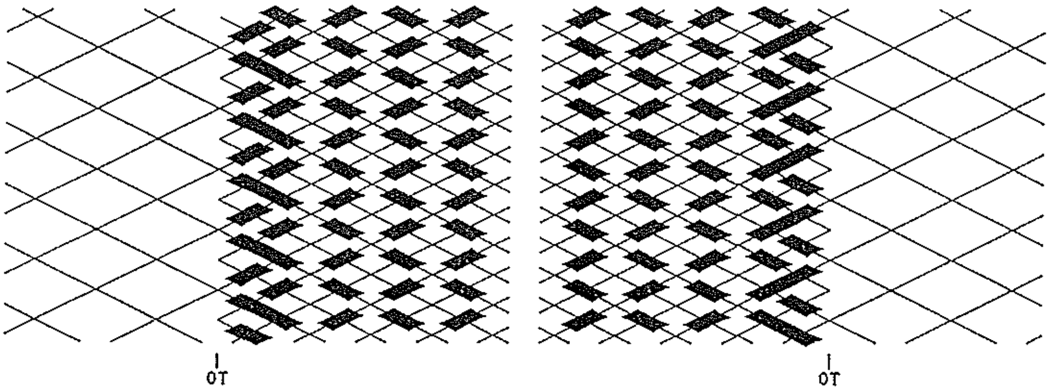


Fig. 962 — Upper central layer not distinctly above the rest of the knot.

THE BRAIDER

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CONTENTS

pg.

The Story of a Copied Knot 1217

A Sliding Lanyard Knot 1244

A quarterly publication
for
the braiding artisan

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The Story of a Copied Knot

Some time ago (a little over six years in fact when this Issue of *The Braider* was being written) we received from a braider an excellent computer colour print-out of his scanned picture of a quirt handle made by him which contained the knot which we will discuss in this article. The braider told us that he had copied the braid from work by Luis B. Ortega and consequently we thought that his copied knot in all its aspects was supposed to resemble the knot on the braidwork he copied it from. Only after some letter exchange did we learn however that he had only seen this **type of knot** on quirts in the catalogue *California Vaquero Traditions* depicting work by Luis B. Ortega and did we receive the important information about the value of the parameter B^* (the number of nests) of his copied knot as well as of the way in which he braided it. Since this catalogue is only of size 219 × 146 mm., the photographs in it are very small and consequently the braidwork shows far to little detail for it to be properly decipherable. Hence the braider was limited to copying the **shape** and **the general Herringbone Pineapple braid-pattern** of the knot in the photographs concerned. Since there are here important lessons to be learned, we shall follow more or less the sequence of comments we made in our letter exchange.

Thus initially we received the computer colour print-out of his scanned picture of the knot on the quirt handle he made (see Fig. 963), but not a single detail of the value used for the parameter B^* of this knot, nor of the way in which he braided the knot.

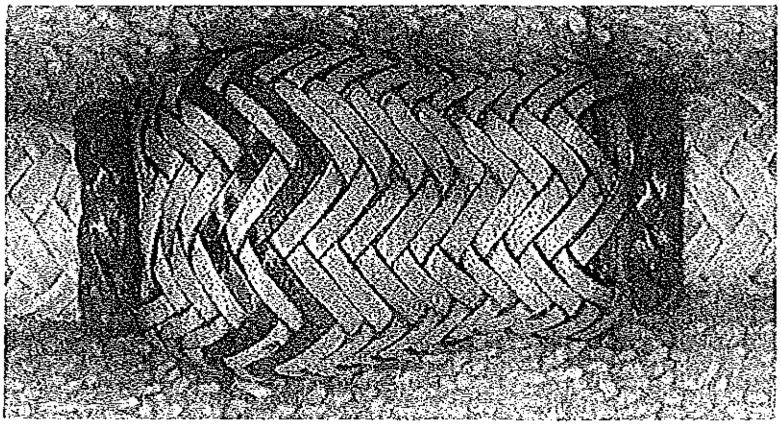

Fig. 963 — The copied knot on the quirt handle.

Thus from this picture in Fig. 963 we had to guess the value of B^*. Since it could have been 5 or 6 and since $B^* = 5$ gives not only a better pattern (a better star-pattern, especially when interbraiding is being used as in our case with the coloured strings), but is more versatile by being **odd**[†], we took B^* to be 5. Next we have to deduce from the picture in Fig. 963 whether or not the Herringbone Pineapple Knot foundation could be a **Perfect** Herringbone Pineapple Knot foundation.

[†] When g.c.d.$(P, B^*) = 1$ the Herringbone Pineapple Knot foundation requires one essential string and is a Perfect Herringbone Pineapple Knot only when made with one string. In high class work one can expect to find such a foundation. Since for a Perfect Herringbone Pineapple Knot with $A =$ **odd** (as in our case with $A = 3$) $x =$ **even** (see *The Braider*, Issue No. 28, pg. 644), hence $P_{total} = P = 2A + x - 2 =$ **even**, it follows that with $B^* =$ **even** a Perfect Herringbone Pineapple Knot is not possible.

A Herringbone Pineapple Knot has rows of \ coding-sets alternating with rows of / coding-sets. Each coding-set consists of A consecutive identical single codings along the same helix. Let there be r_h coding-sets in a row of / coding-sets and let there be l_h coding-sets in a row of \ coding-sets. When $l_h = r_h$, the Herringbone Pineapple Knot is either a Standard Herringbone Pineapple Knot or a Semi-Standard Herringbone Pineapple Knot (with $y = A$). When $l_h = r_h - 1$, the Herringbone Pineapple Knot is a Perfect Herringbone Pineapple Knot or a Semi-Perfect Herringbone Pineapple Knot with $y = A - 1$. When $l_h = r_h + 1$, the Herringbone Pineapple Knot is a Perfect Herringbone Pineapple Knot or a Semi-Perfect Herringbone Pineapple Knot with $y = A + 1$. For any of these six types of Herringbone Pineapple Knots we have:

$$P_{total} = A + (l_h + r_h),$$

$$x = P_{total} + 2 - 2A = (l_h + r_h) + 2 - A,$$

$$k = \left|\frac{x-y-2}{2}\right|_A = |l_h|_A = |r_h|_A \quad \text{when } l_h = r_h, \text{ hence } y = A,$$

$$k = \left|\frac{x-y-2}{2}\right|_A = |l_h + 1|_A = |r_h|_A \quad \text{when } l_h = r_h - 1, \text{ hence } y = A - 1,$$

$$k = \left|\frac{x-y-2}{2}\right|_A = |l_h - 1|_A = |r_h|_A \quad \text{when } l_h = r_h + 1, \text{ hence } y = A + 1,$$

For the Standard and Semi-Standard Herringbone Pineapple Knots we have in addition:

$|l_h|_A = |r_h|_A =$ number of components with $P_c = 3 + \frac{2(l_h)-2|l_h|_A}{A} = 3 + \frac{2(r_h)-2|r_h|_A}{A}$ each. For these components: $l_i + r_i = k + 1$.

$A - |l_h|_A = A - |r_h|_A =$ number of components with $P_c = 1 + \frac{2(l_h)-2|l_h|_A}{A} = 1 + \frac{2(r_h)-2|r_h|_A}{A}$ each. For these components: $l_i + r_i = k + 1 + A$.

The foundation Herringbone Pineapple Knot of the knot in Fig. 963 has either

1. $A = 3$, $l_h = 13$, $r_h = 14$, or
2. $A = 3$, $l_h = 14$, $r_h = 14$.

For case 1. we see that the foundation knot is a Perfect or a Semi-Perfect Herringbone Pineapple Knot with $P_{total} = P = A + (l_h + r_h) = 3 + (13 + 14) = 30$, $x = (l_h + r_h) + 2 - A = (13 + 14) + 2 - 3 = 26$, $k = |l_h + 1|_A = |r_h|_A = |13 + 1|_3 = |14|_3 = 2$. Since g.c.d.$(P, B^*) =$ g.c.d.$(30, 5) = 5$, we require five essential strings for this Semi-Perfect Herringbone Pineapple Knot.

The grid-diagrams of this knot and its foundation knot would therefore be as depicted in Fig. 964. Note that **in the overall braid** the bights in each nest of the foundation knot are nicely aligned at the left bight-edge and that the left-hand bights of the two interbraided components are also nicely aligned with the left-hand bights of the foundation knot. **In the overall braid**, the bights in each nest on the right-hand bight-edge of the foundation knot are not nicely aligned, but the practical braider would not be able to notice that of course (in the foundation knot itself, the bights in each left-hand nest **and** in each right-hand nest are nicely lined up).

The foundation knot is a Semi-Perfect Herringbone Pineapple Knot, hence not a type of knot well known to most braiders. It requires five essential strings which, apart from anything else, is **not** a good proposition for high quality braidwork. Furthermore, each of the **five** sub-components of the foundation knot has a string-run which is not an obvious result from (practical) experimentation. It is thus most unlikely that the grid-diagram in Fig. 964 resembles the knot made by Luis B. Ortega.

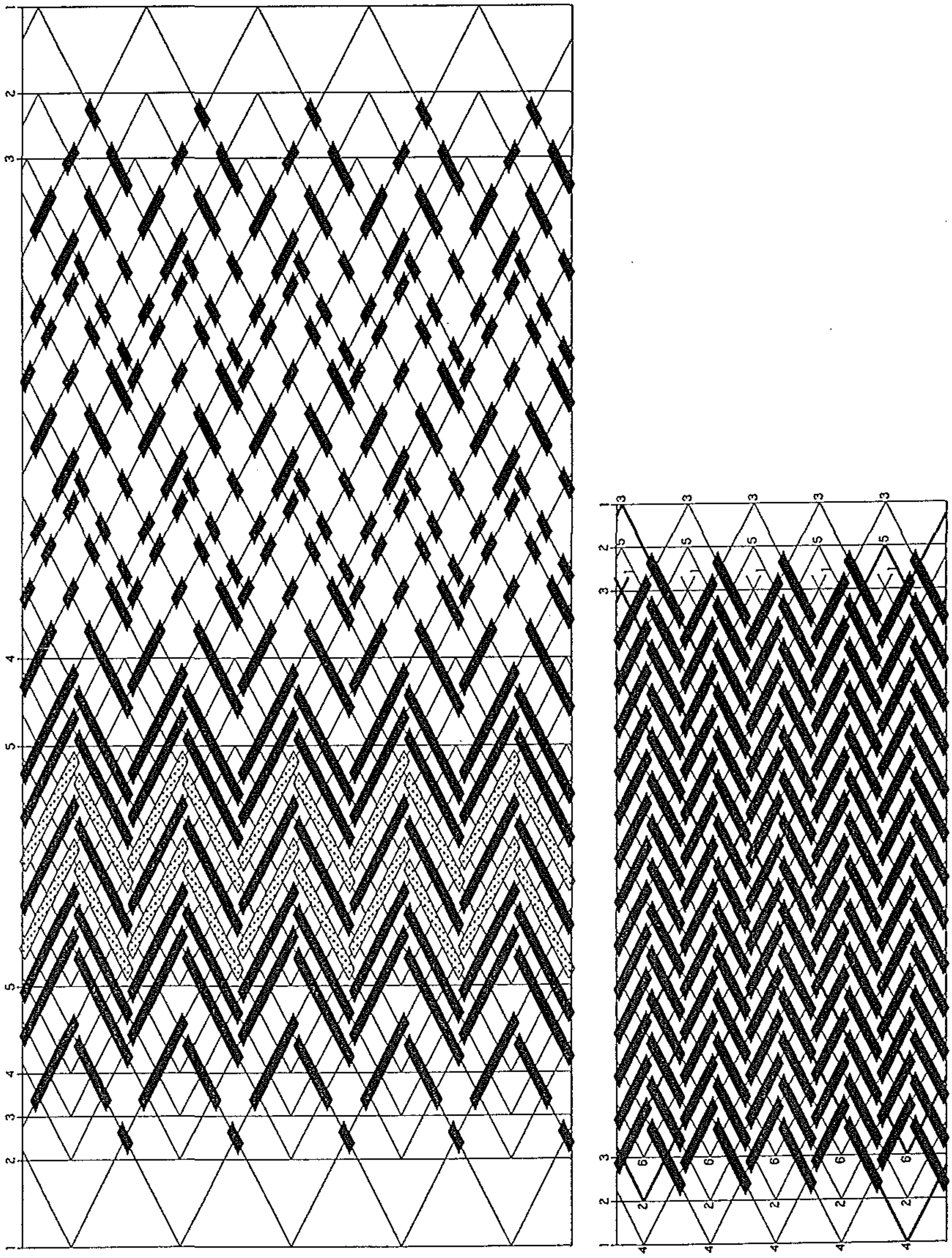

Fig. 964 — $A = 3$, $B^* = 5$, $l_h = 13$, $r_h = 14$, $x = 26$, $k = 2$, $y = A - 1 = 2$.

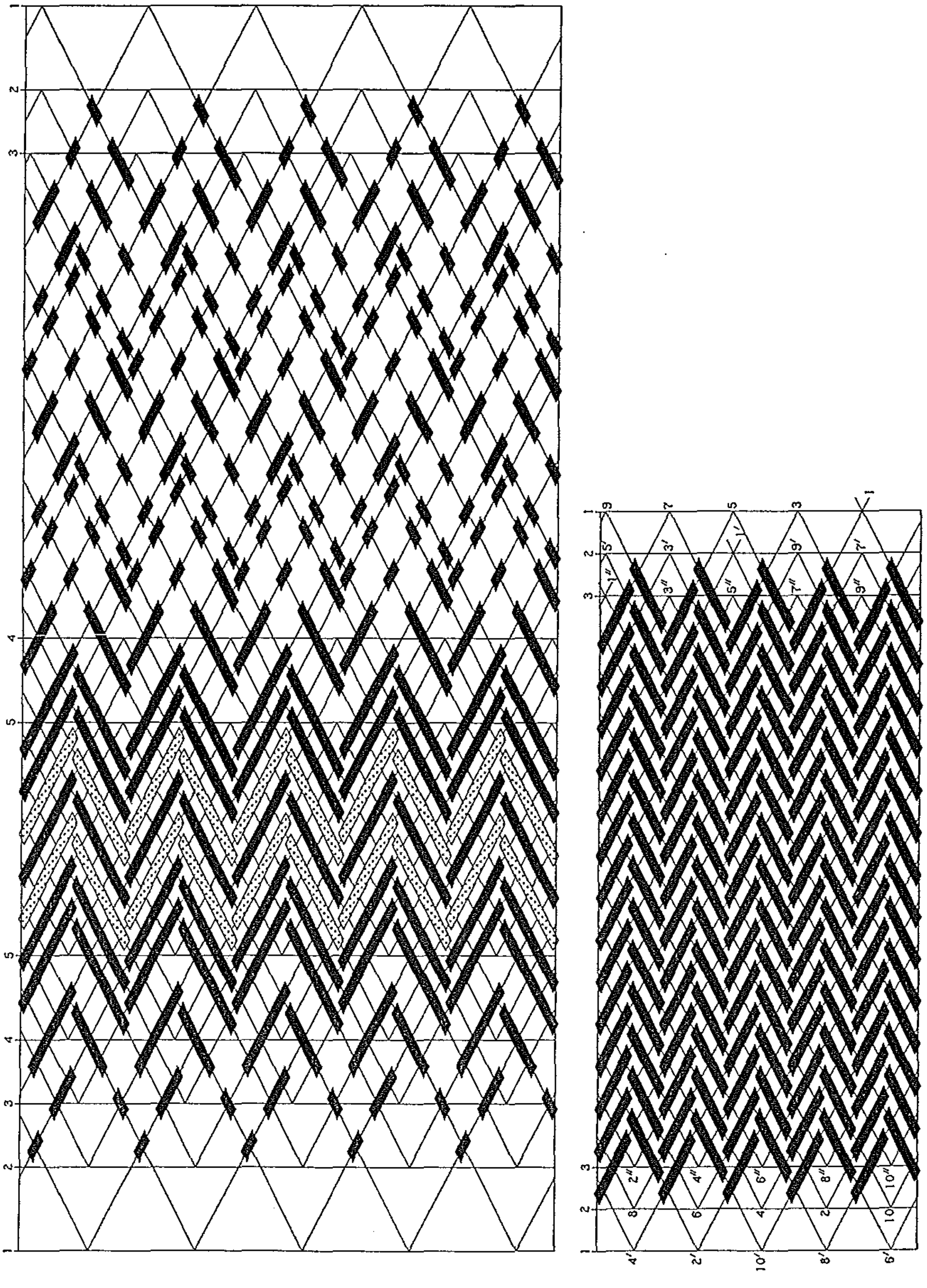

Fig. 965 — $A = 3$, $B^* = 5$, $l_h = r_h = 14$, $x = 27$, $k = 2$, $y = A = 3$.

For case **2.** we see that the foundation knot is a Standard or a Semi-Standard Herringbone Pineapple Knot with $P_{total} = A + (l_h + r_h) = 3 + (14 + 14) = 31$, $x = (l_h + r_h) + 2 - A = (14 + 14) + 2 - 3 = 27$ and $k = |l_h|_A = |r_h|_A = |14|_3 = 2$. This foundation knot has two sets of components:

One set with $|l_h|_A = |r_h|_A = |14|_3 = 2$ components, with each component having $P_c = 3 + \frac{2(l_h)-2|l_h|_A}{A} = 3 + \frac{2(r_h)-2|r_h|_A}{A} = 3 + \frac{2\times 14-2|14|_3}{3} = 11 = P_{c_1}$, and one set with $A - |l_h|_A = A - |r_h|_A = 3 - |14|_3 = 1$ component which has $P_c = 1 + \frac{2(l_h)-2|l_h|_A}{A} = 1 + \frac{2(r_h)-2|r_h|_A}{A} = 1 + \frac{2\times 14-2|14|_3}{3} = 9 = P_{c_2}$.

Since g.c.d.$(P_{c_1}, B^*) =$ g.c.d.$(11,5) = 1$, and g.c.d.$(P_{c_2}, B^*) =$ g.c.d.$(9,5) = 1$, the foundation knot is a Standard Herringbone Pineapple Knot and hence it requires three essential strings (three components with no sub-components).

The grid-diagrams of this knot and its foundation knot would therefore be as depicted in Fig. 965. Note that **in the overall braid** the bights in each nest of the foundation knot are **not** nicely aligned at the left bight-edge and that the left-hand bights of the two interbraided components are also **not** nicely aligned with any of the left-hand bights of the foundation knot. **In the overall braid**, the bights in each nest on the right-hand bight-edge of the foundation knot are not nicely aligned, but the practical braider would again not be able to notice that of course (in the foundation knot itself, the bights in each left-hand nest **and** in each right-hand nest are nicely aligned).

Not only does the foundation knot require **three** essential strings **and** not only is it a Standard Herringbone Pineapple Knot, a type of knot well-known to most braiders, but each sub-component is a typical pattern-braiders under-over coded Regular Knot; hence the foundation knot is a pattern-braiders type of Standard Herringbone Pinapple Knot, consequently even more well-known to most braiders (sub-components between R_1 and L_2, and respectively between R_2 and L_1 each with $p = 11$ parts and $b = 5$ bights, and the sub-component between R_3 and L_3 with $p = 9$ parts and $b = 5$ bights; hence $p = nb \pm 1$). It is thus very likely that the knot in Fig. 963 is represented by the grid-diagram in Fig. 965. Since it is preferable to use the minimum number of essential strings in the overall knot, interbraiding this knot as indicated by the grid-diagram in Fig. 966 is to be preferred.

Let's now return to Fig. 964. We have seen that $x = 26$ in the foundation knot depicted in Fig. 964. By decreasing $x = 26$ slightly to $x = 25$, we obtain the interbraided knot with its foundation knot in Fig. 967 ($l_h + r_h = x + A - 2 = 25 + 3 - 2 = 26$, hence $l_h = r_h = 13$; consequently $k = \left|\frac{x-y-2}{2}\right|_A = \left|\frac{25-3-2}{2}\right|_3 = 1$). The foundation knot is a pattern-braiders type of Standard Herringbone Pineapple Knot (its sub-component between R_1 and L_1 has $p = 11$ parts and $b = 5$ bights, while its sub-components between R_2 and L_3, and respectively between R_3 and L_2 have each $p = 9$ parts and $b = 5$ bights; hence $p = nb \pm 1$).

By increasing $x = 26$ slightly to $x = 27$, we obtain the interbraided knot with its foundation knot in Fig. 968 ($l_h + r_h = x + A - 2 = 27 + 3 - 2 = 28$, hence $l_h = r_h = 14$; consequently $k = \left|\frac{x-y-2}{2}\right|_A = \left|\frac{27-3-2}{2}\right|_3 = 2$). The foundation knot is a pattern-braiders type of Standard Herringbone Pineapple Knot (its sub-components between R_1 and L_2, and respectively between R_2 and L_1 have each $p = 11$ parts and $b = 5$ bights, while its sub-component between R_3 and L_3 has $p = 9$ parts and $b = 5$ bights; hence $p = nb \pm 1$). Note that the foundation knot in Fig. 965 and Fig. 968 are identical, but their position in the overall interbraided knots are reversed.

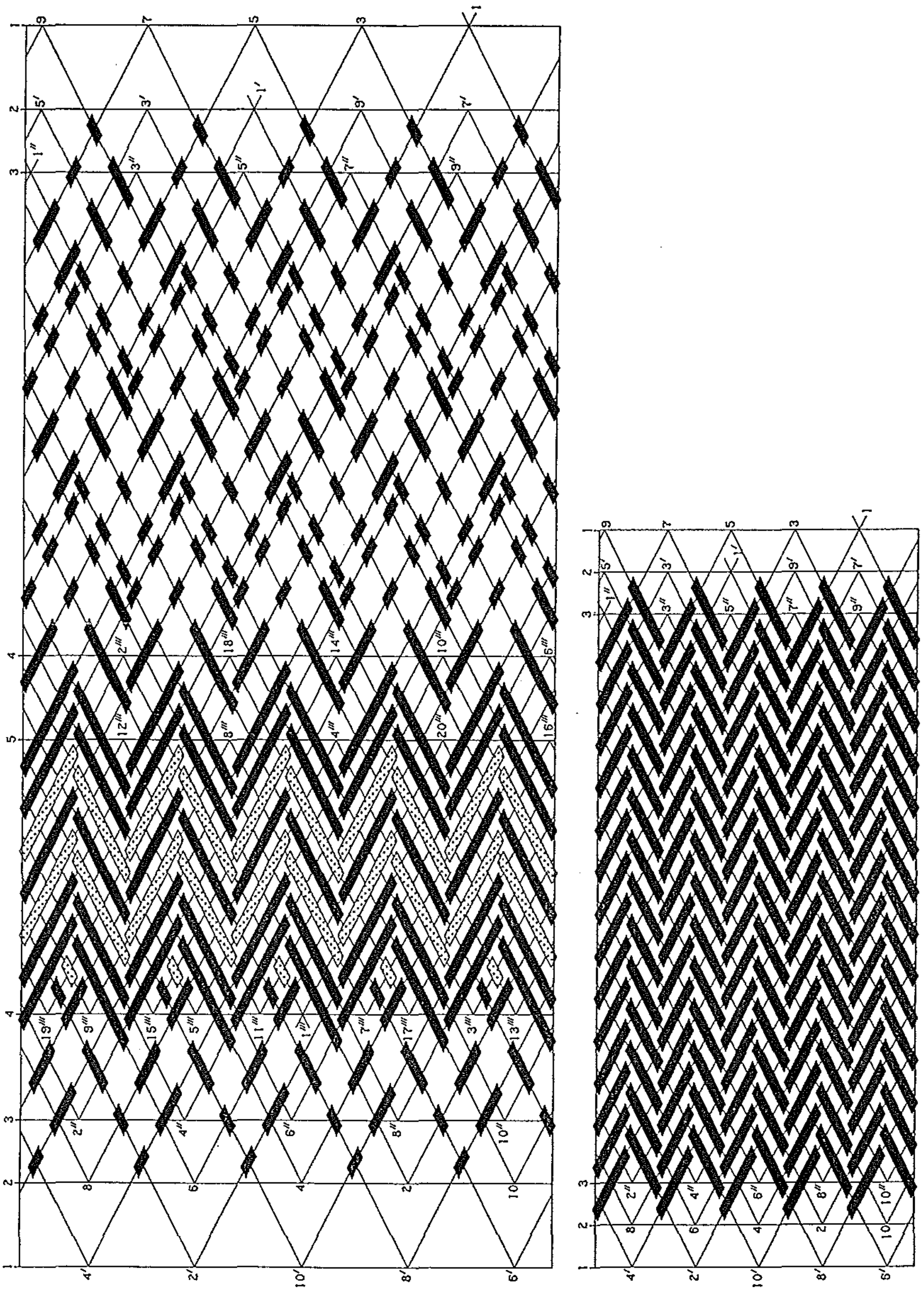

Fig. 966 — See text on pg. 1221.

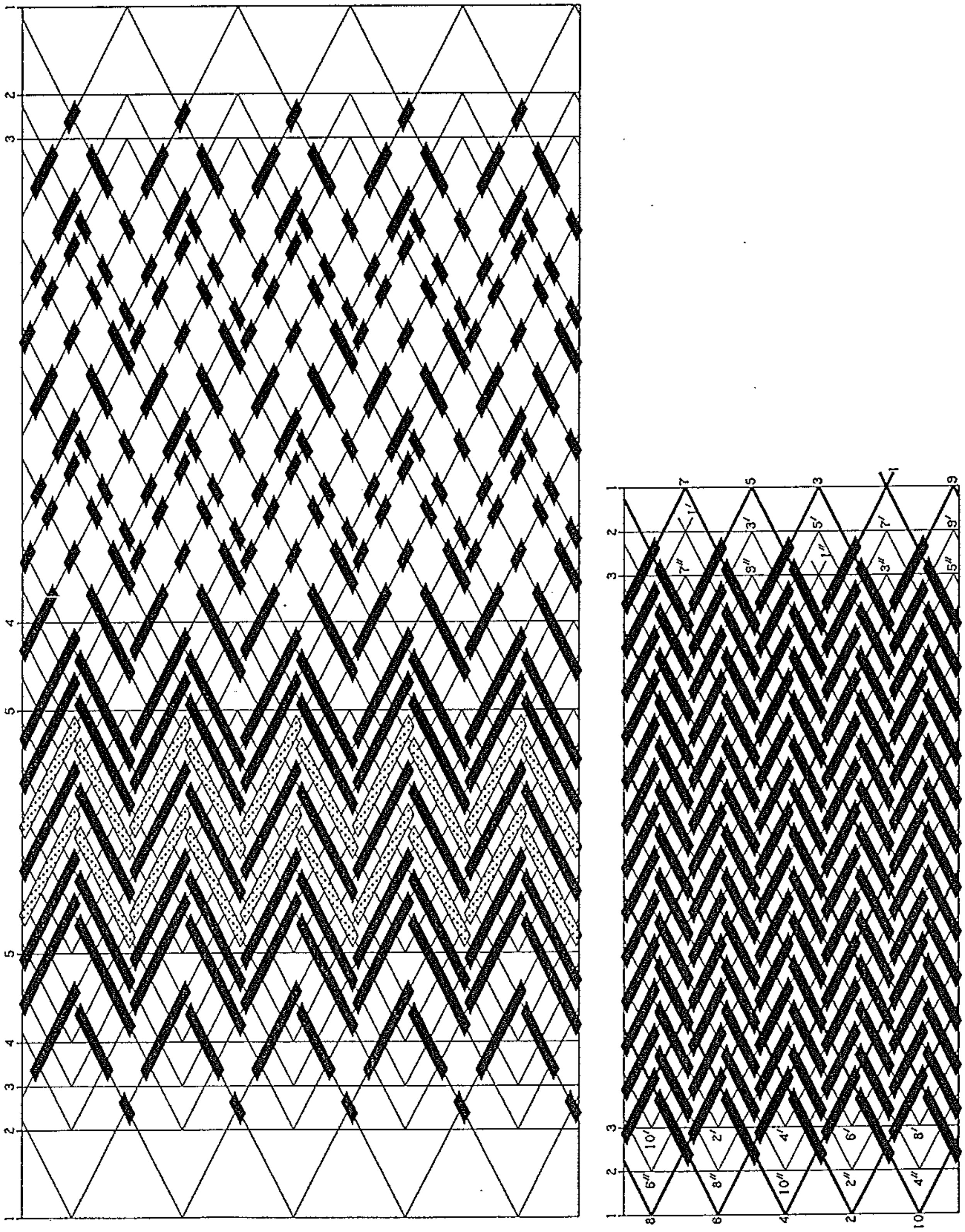

Fig. 967 — $A = 3$, $B^* = 5$, $l_h = r_h = 13$, $x = 25$, $k = 1$, $y = A = 3$.

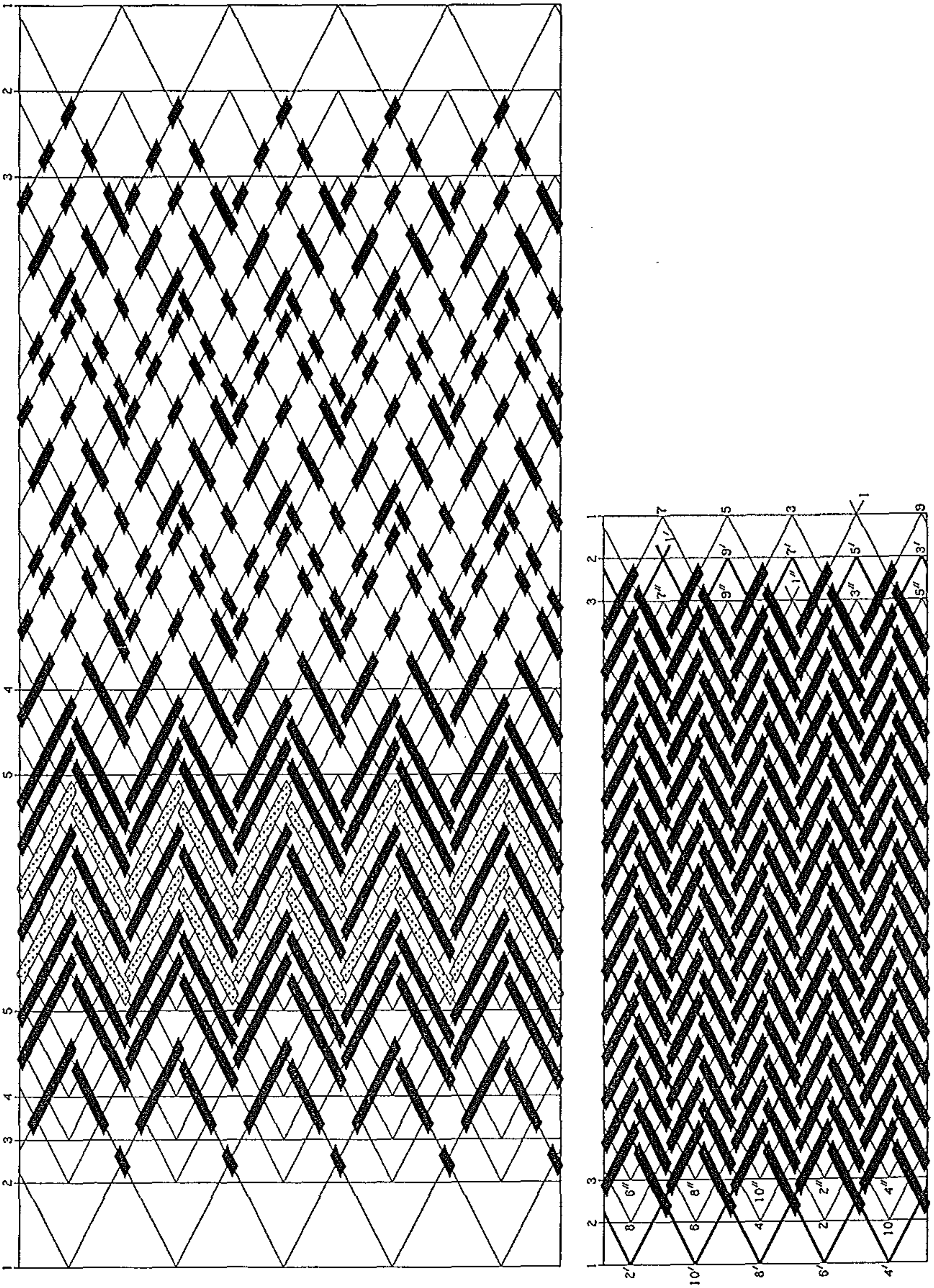

Fig. 968 — $A = 3$, $B^* = 5$, $l_h = r_h = 14$, $x = 27$, $k = 2$, $y = A = 3$.

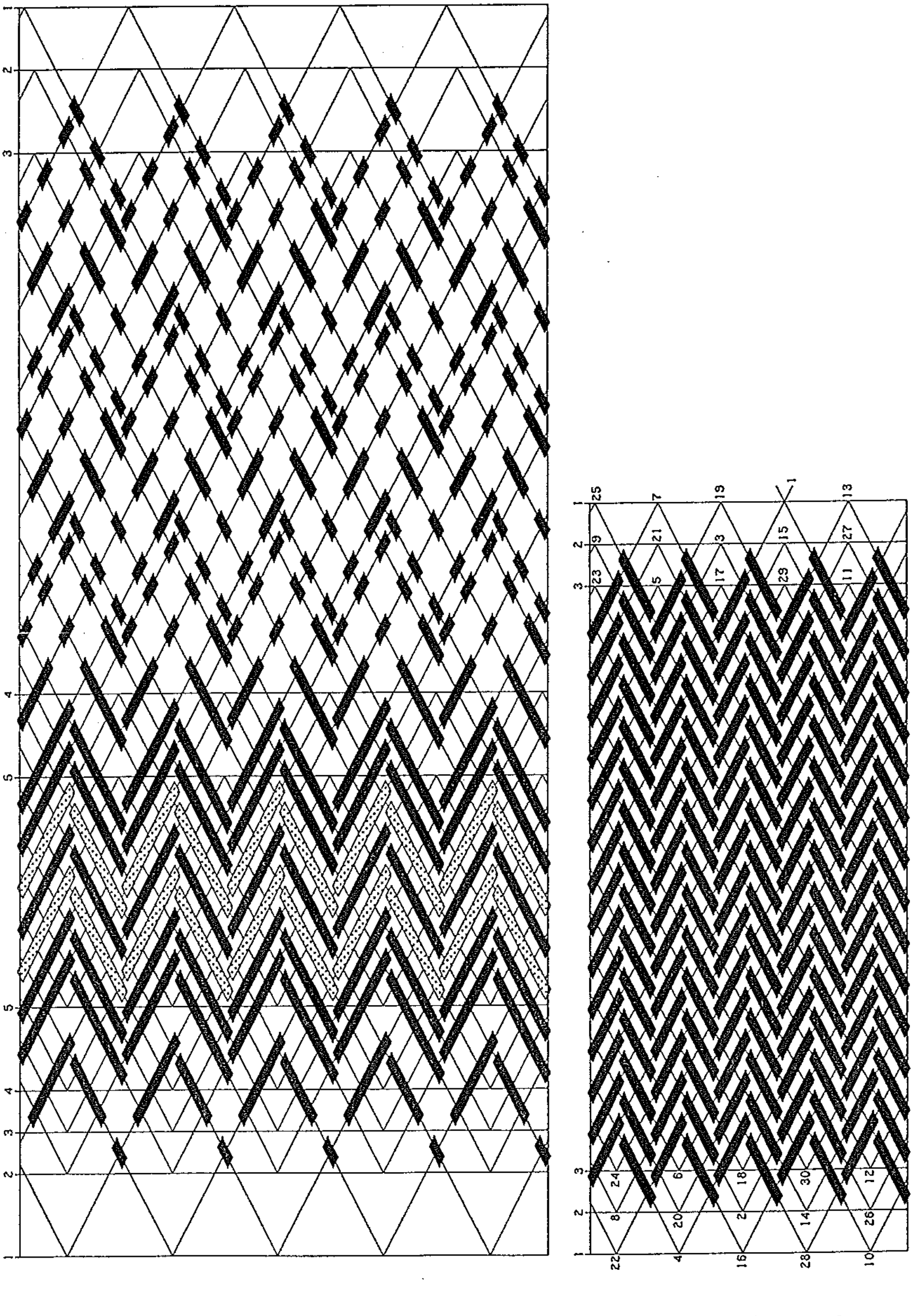

Fig. 969 — $A = 3$, $B^* = 5$, $l_h = 14$, $r_h = 15$, $x = 28$, $k = 3$, $y = A - 1 = 2$.

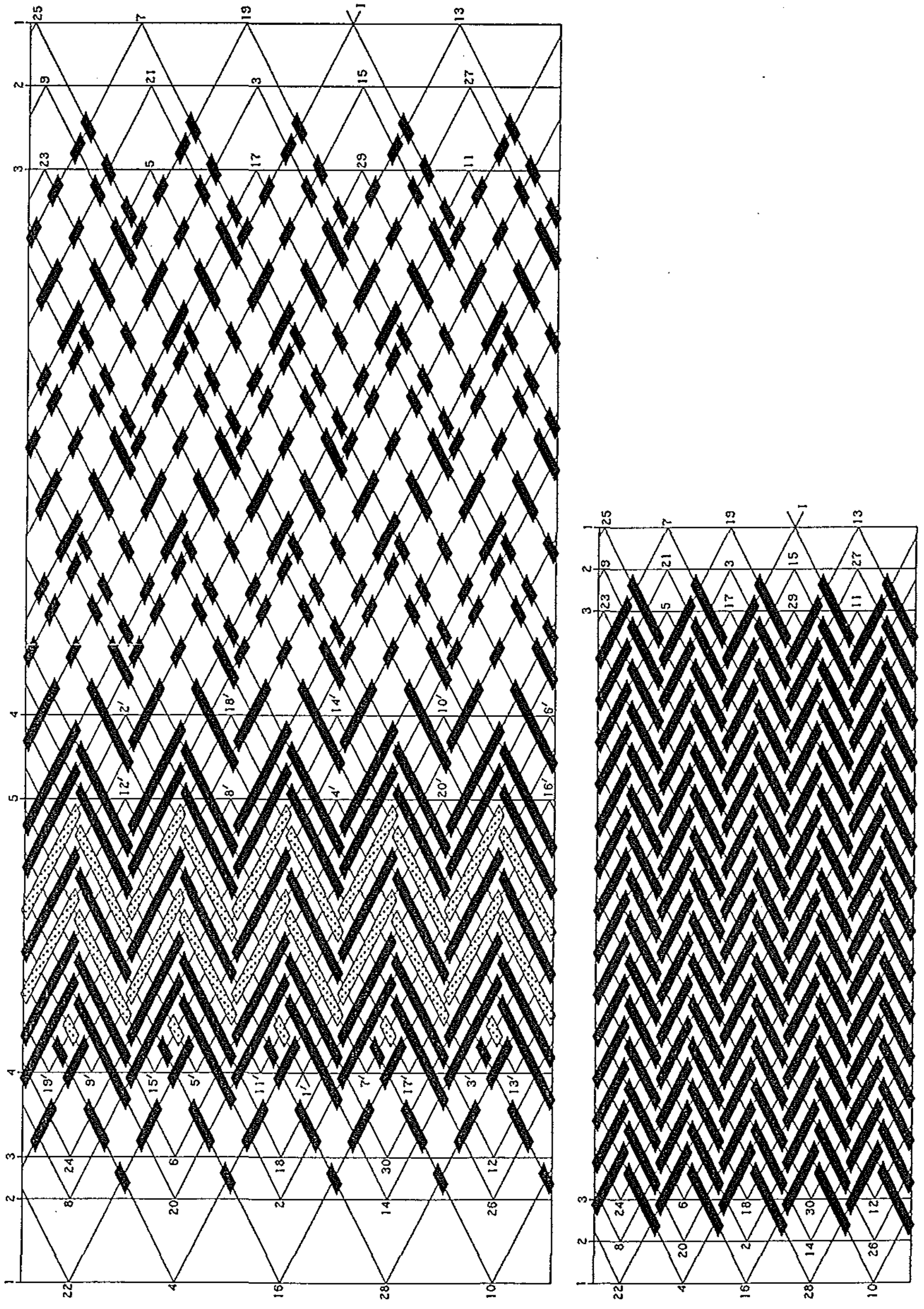

Fig. 970 — See text on pg. 1227.

Let's increase x a little more to $x = 28$. Then the foundation knot becomes a Perfect Herringbone Pineapple Knot, hence requires only one essential string. Its grid-diagram and the grid-diagram of its associated interbraided knot are depicted in Fig. 969 ($l_h + r_h = x + A - 2 = 28 + 3 - 2 = 29$, hence $l_h = 14$, $r_h = 15$; consequently $k = \left|\frac{x-y-2}{2}\right|_A = \left|\frac{28-2-2}{2}\right|_3 = 3$). This interbraided knot, which requires a total of **three** essential strings is in practice to be preferred (**three** essential strings in Fig. 969 against **five** essential strings in Fig. 965), however, we can reduce the number of essential strings even further to **two** by braiding the interbraid as shown in Fig. 970. Obviously the interbraided knot in Fig. 970 should preferably be used in practice (**two** essential strings in Fig. 970 against **four** essential strings in Fig. 966).

Let's get back to the naming of these knots in the set [Fig. 964, Fig. 967, Fig. 968, Fig. 969, Fig. 970] and in the set [Fig. 965, Fig. 966]. In the first set the visible interbraid is aligned within the foundation knot, while in the second set the visible interbraid is not aligned within the foundation knot. In the first set we have the sub-sets [Fig. 967, Fig. 968], [Fig. 969, Fig. 970] and [Fig. 964]. In the sub-set [Fig. 967, Fig. 968], the foundation knot is a Standard Herringbone Pineapple Knot. In the sub-set [Fig. 969, Fig. 970], the foundation knot is a Perfect Herringbone Pineapple Knot. In the sub-set [Fig. 964], the foundation knot is a Semi-Perfect Herringbone Pineapple Knot. In the second set [Fig. 965, Fig. 966], the foundation knot is a Standard Herringbone Pineapple Knot. Furthermore, the interbraid itself in [Fig. 966, Fig. 970] differs from the one in [Fig. 964, Fig. 967, Fig. 968, Fig. 969, Fig. 970]. Although the braids in the two sets [Fig. 964, Fig. 967, Fig. 968, Fig. 969, Fig. 970] and [Fig. 965, Fig. 966] look superficially alike, they are however not alike; the only thing they have in common is their shape.

This interbraiding of the foundation knots has the aim to offset to a greater or lesser extent the increase in the helix-angle of the strings over the swell. If the effective circumference of the surface under the braid is C_s, the effective strand-width is w, the angle α is 90° minus the helix-angle, the number of bights is b, then $C_s = nz = \frac{nw}{\sin\alpha} = \frac{bw}{\sin\alpha}$, hence $n = b = \frac{C_s \cdot \sin\alpha}{w}$ (see Fig. 971).

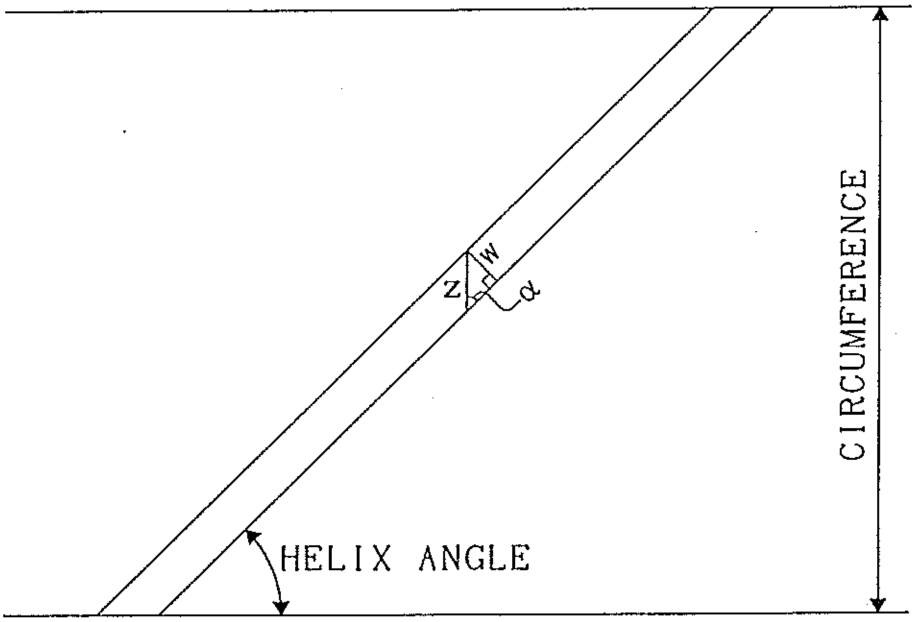

Fig. 971 — Circumference, strand-width and helix-angle.

Thus when C_s increases, α decreases when w and $n = b$ do not change, or when limiting the decrease in α (hence limiting the increase in the helix-angle), $n = b$ must increase when w does not change. This increase in n (n represents the number of left-helix strands which is equal to the number of right-helix strands) does not have to be with strands of a different colour, although for ornamental reasons this is often the case. The actual string-run of such an interbraided strand or strands does in general not follow exactly the path indicated in the grid-diagram, but good interbraiding will not show that. Hence how such interbraiding is done is unimportant as long as it is aesthetically compatible with the pattern of the braid of the foundation knot (see for example Fig. 965, Fig. 966, Fig. 967).

Eventually the braider informed us that he had used six strings and had laid them all down in alternating left and right helix stages. In other words $B^* = 6$ and the braiding was done by using the parallel braiding method[†]. Since in the foundation knot with $A = 3$, $l_h = 13$, $r_h = 14$, $B^* = 6$, hence $P_{total} = P = 30$ we require six essential strings, his choice of foundation knot was very easy to braid by means of the parallel braiding method, but was at the same time a knot which should not be used on high quality work (it is a type of knot one can expect to find on mass-produced braidwork or braidwork produced by a novice). In better quality braidwork we would expect to find a foundation knot with either $l_h = 15$, $r_h = 14$ or $l_h = 14$, $r_h = 15$ or $l_h = 13$, $r_h = 12$ or $l_h = 12$, $r_h = 13$. In each of these cases the foundation knot is a Semi-Perfect Herringbone Pineapple Knot which requires only two essential strings! We can, of course, still braid those foundation knots with six strings instead of two, but that would clearly indicate that the braider does not know what can be done with only a little more effort while obtaining a much higher quality in artistic braiding sense let alone craftsmanship. Hence let's show in an example what should and what should not be done for obtaining high quality braidwork.

Let $l_h = 15$ and $r_h = 14$. Let $A = 3$ and $B^* = 6$. We thus have:

$$l_h = r_h + 1 \qquad \longrightarrow y = A + 1\,,$$

$$x = l_h + r_h + 2 - A = 15 + 14 + 2 - 3 = 28\,,$$

$$P_{total} = P = l_h + r_h + A = 15 + 14 + 3 = 32\,,$$

$$\text{g.c.d.}\,(P, B^*) = \text{g.c.d.}\,(32, 6) = 2 \qquad \longrightarrow \text{hence 2 essential strings required}\,,$$

$$k = |l_h - 1|_A = |r_h|_A = |14|_3 = 2\,.$$

For the conventional first-return string-run see upper-left diagram in Fig. 972. Place the Standing Ends of the two essential strings on right-hand side with the Standing

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[†] Let there be m strings in the string-set which generate the left-helix and the right-helix string-run half-cycles; then the braid consists of $2n$ sets each of m string-run half-cycles ($2nm = 2AB^* = 2B$). The m string-run half-cycles in a string-run half-cycle set have all the same orientation but do not necessarily have the same bight-boundaries. In the parallel braiding method, each of the m strings completes its string-run half-cycle in the j^{th} string-run half-cycle set before starting with the string-run half-cycles of the $(j+1)^{th}$ string-run half-cycle set. Any string of the string-set can be replaced by a different colour string for the whole or part of its string-length. In the most commonly used parallel braiding method, the Standing Ends of the m strings are placed at the same bight-boundary and are regularly spaced over the total number of bights) In high class braidwork we should not use an excessive number of strings and hence multi-string core covering braids with m greater than the number of essential strings should only be used when the string-length of the essential strings is getting too long.

End half-cycle running from lower-right to upper-left; draw first-return string-run in accordance (see upper-right diagram in Fig. 972).

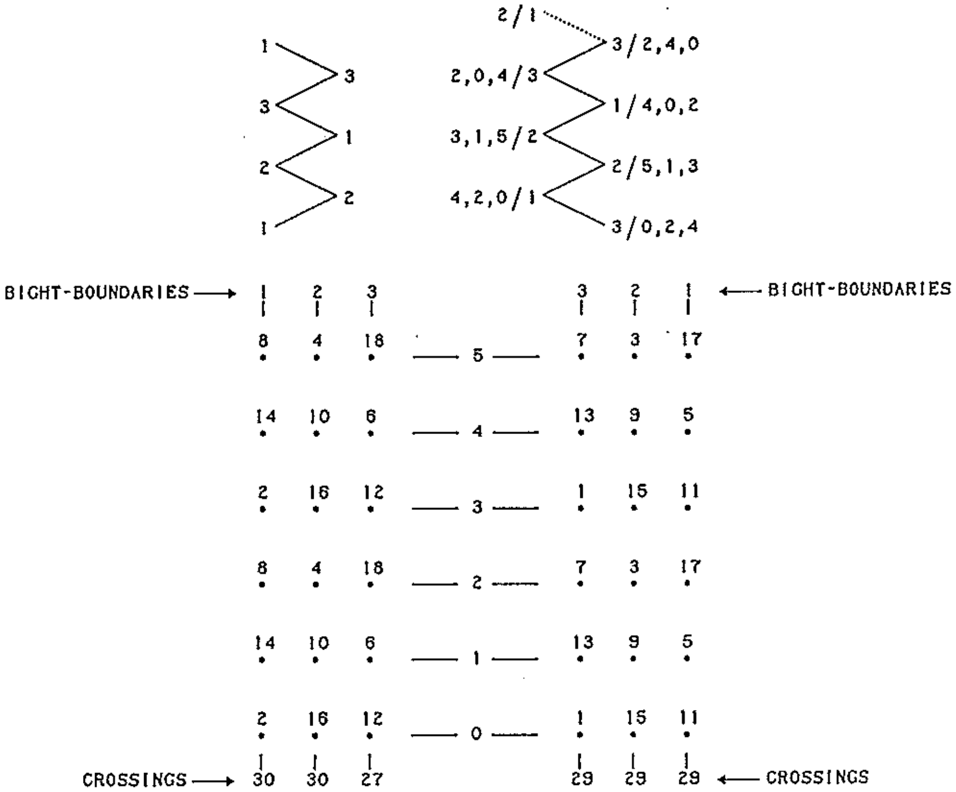


Fig. 972 — First-return string-run of one string and half-cycle pattern for $m = 2$.

Add to this first-return string-run diagram for one essential string the nest-index numbers; the nest at the beginning of the first half-cycle receives the nest-index number $I_R^* = I_1^* = 0$, and the nest at the end of the first half-cycle receives the nest-index number $I_L^* = I_{1'}^* = 0$. The nest at the beginning of the second half-cycle is the nest at the end of the first half-cycle and the nest at the end of the second half-cycle receives the nest-index number $I_R^* = I_2^* = |I_1^* + \Delta I_1^*|_{B^*}$. The nest at the beginning of the third half-cycle is the nest at the end of the second half-cycle and the nest at the end of the third half-cycle receives the nest-index number $I_L^* = I_{2'}^* = |I_{1'}^* + \Delta I_{1'}^*|_{B^*}$. The nest at the beginning of the fourth half-cycle is the nest at the end of the third half-cycle and the nest at the end of the fourth half-cycle receives the nest-index number $I_R^* = I_3^* = |I_2^* + \Delta I_2^*|_{B^*}$. The nest at the beginning of the fifth half-cycle is the nest at the end of the fourth half-cycle and the nest at the end of the fifth half-cycle receives the nest-index number $I_L^* = I_{3'}^* = |I_{2'}^* + \Delta I_{2'}^*|_{B^*}$. And so on. Hence:

Half-cycle 1 begins at right bight-boundary $r_1 = 3$ and nest-index number $I_R^* = I_1^* = 0$. It ends at left bight-boundary $l_1 = 1$ and nest-index number $I_L^* = I_{1'}^* = 0$.

Half-cycle 2 begins at left bight-boundary $l_1 = 1$ and nest-index number $I_l^* = I_{1'}^* = 0$. It ends at right bight-boundary $r_2 = 2$ and nest-index number $I_R^* = I_2^* = \cdots$.

Half-cycle 3 begins at right bight-boundary $r_2 = 2$ and nest-index number $I_R^* = I_2^* = \cdots$. It ends at left bight-boundary $l_2 = 2$ and nest-index number $I_L^* = I_{2'}^* = \cdots$.

Half-cycle 4 begins at left bight-boundary $l_2 = 2$ and nest-index number $I_l^* = I_{2'}^* = \cdots$. It ends at right bight-boundary $r_3 = 1$ and nest-index number $I_R^* = I_3^* = \cdots$.

Half-cycle 5 begins at right bight-boundary $r_3 = 1$ and nest-index number $I_R^* = I_3^* = \cdots$. It ends at left bight-boundary $l_3 = 3$ and nest-index number $I_L^* = I_{3'}^* = \cdots$.

Half-cycle 6 begins at left bight-boundary $l_3 = 3$ and nest-index number $I_l^* = I_{3'}^* = \cdots$. It ends at right bight-boundary $r_4 = r_1 = 3$ and nest-index number $I_R^* = I_4^* = \cdots$.

Half-cycle 7 begins at right bight-boundary $r_4 = r_1 = 3$ and nest-index number $I_R^* = I_4^* = \cdots$. It ends at left bight-boundary $l_4 = l_1 = 1$ and nest-index number $I_L^* = I_{4'}^* = \cdots$.

Half-cycle 8 begins at left bight-boundary $l_4 = l_1 = 1$ and nest-index number $I_l^* = I_{4'}^* = \cdots$. It ends at right bight-boundary $r_5 = r_2 = 2$ and nest-index number $I_R^* = I_5^* = \cdots$.

Half-cycle 9 begins at right bight-boundary $r_5 = r_2 = 2$ and nest-index number $I_R^* = I_5^* = \cdots$. It ends at left bight-boundary $l_5 = l_2 = 2$ and nest-index number $I_L^* = I_{5'}^* = \cdots$.

Half-cycle 10 begins at left bight-boundary $l_5 = l_2 = 2$ and nest-index number $I_l^* = I_{5'}^* = \cdots$. It ends at right bight-boundary $r_6 = r_3 = 1$ and nest-index number $I_R^* = I_6^* = \cdots$.

Half-cycle 11 begins at right bight-boundary $r_6 = r_3 = 1$ and nest-index number $I_R^* = I_6^* = \cdots$. It ends at left bight-boundary $l_6 = l_3 = 3$ and nest-index number $I_L^* = I_{6'}^* = \cdots$.

Half-cycle 12 begins at left bight-boundary $l_6 = l_3 = 3$ and nest-index number $I_l^* = I_{6'}^* = \cdots$. It ends at right bight-boundary $r_7 = r_1 = 3$ and nest-index number $I_R^* = I_7^* = \cdots$.

Half-cycle 13 begins at right bight-boundary $r_7 = r_1 = 3$ and nest-index number $I_R^* = I_7^* = \cdots$. It ends at left bight-boundary $l_7 = l_1 = 1$ and nest-index number $I_L^* = I_{7'}^* = \cdots$.

Half-cycle 14 begins at left bight-boundary $l_7 = l_1 = 1$ and nest-index number $I_l^* = I_{7'}^* = \cdots$. It ends at right bight-boundary $r_8 = r_2 = 2$ and nest-index number $I_R^* = I_8^* = \cdots$.

Half-cycle 15 begins at right bight-boundary $r_8 = r_2 = 2$ and nest-index number $I_R^* = I_8^* = \cdots$. It ends at left bight-boundary $l_8 = l_2 = 2$ and nest-index number $I_L^* = I_{8'}^* = \cdots$.

Half-cycle 16 begins at left bight-boundary $l_8 = l_2 = 2$ and nest-index number $I_l^* = I_{8'}^* = \cdots$. It ends at right bight-boundary $r_9 = r_3 = 1$ and nest-index number $I_R^* = I_9^* = \cdots$.

Half-cycle 17 begins at right bight-boundary $r_9 = r_3 = 1$ and nest-index number $I_R^* = I_9^* = \cdots$. It ends at left bight-boundary $l_9 = l_3 = 3$ and nest-index number $I_L^* = I_{9'}^* = \cdots$.

Half-cycle 18 begins at left bight-boundary $l_9 = l_3 = 3$ and nest-index number $I_l^* = I_{9'}^* = \cdots$. It ends at right bight-boundary $r_{10} = r_1 = 3$ (the beginning of half-cycle 1) and nest-index number $I_R^* = I_{10}^* = I_1^* = 0$.

The calculations for the entries $= \cdots$ are as follows:

$$I_1^* = 0\,,$$

$$I_{1'}^* = 0\,,$$

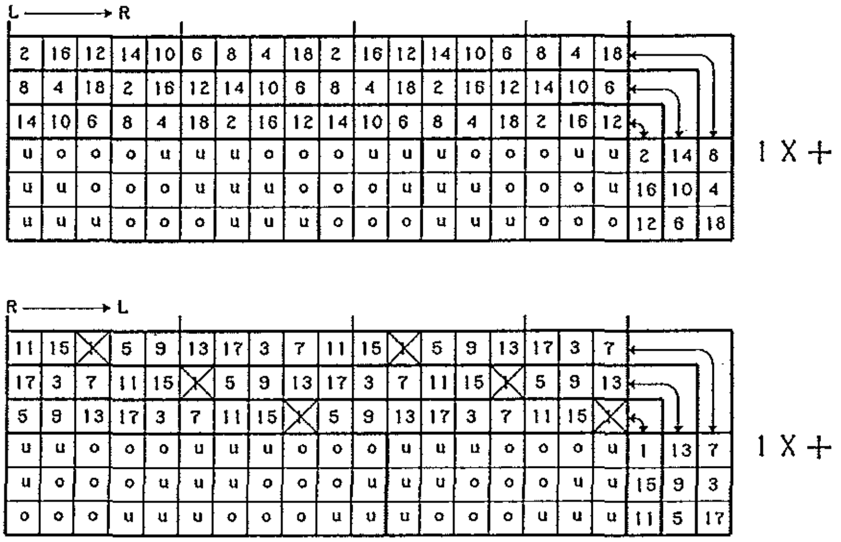
$$I_2^* = |I_1^* + \Delta I_1^*|_{B^*} = \left| I_1^* + \frac{|4A + x - (r_1 + r_2 + 2l_1)|_B}{A} \right|_{B^*} = \left| 0 + \frac{|40 - 7|_{18}}{3} \right|_6 = 5\,,$$

$$
\begin{aligned}
I^*_{2'} &= |I^*_{1'} + \Delta I^*_{1'}|_{B^*} = \left| I^*_{1'} + \frac{|4A + x - (l_1 + l_2 + 2r_2)|_B}{A} \right|_{B^*} = \left| 0 + \frac{|40 - 7|_{18}}{3} \right|_6 = 5\,, \\
I^*_3 &= |I^*_2 + \Delta I^*_2|_{B^*} = \left| I^*_2 + \frac{|4A + x - (r_2 + r_3 + 2l_2)|_B}{A} \right|_{B^*} = \left| 5 + \frac{|40 - 7|_{18}}{3} \right|_6 = 4\,, \\
I^*_{3'} &= |I^*_{2'} + \Delta I^*_{2'}|_{B^*} = \left| I^*_{2'} + \frac{|4A + x - (l_2 + l_3 + 2r_3)|_B}{A} \right|_{B^*} = \left| 5 + \frac{|40 - 7|_{18}}{3} \right|_6 = 4\,, \\
I^*_4 &= |I^*_3 + \Delta I^*_3|_{B^*} = \left| I^*_3 + \frac{|4A + x - (r_3 + r_4 + 2l_3)|_B}{A} \right|_{B^*} = \left| 4 + \frac{|40 - 10|_{18}}{3} \right|_6 = 2\,, \\
I^*_{4'} &= |I^*_{3'} + \Delta I^*_{3'}|_{B^*} = \left| I^*_{3'} + \frac{|4A + x - (l_3 + l_4 + 2r_4)|_B}{A} \right|_{B^*} = \left| 4 + \frac{|40 - 10|_{18}}{3} \right|_6 = 2\,, \\
I^*_5 &= |I^*_4 + \Delta I^*_4|_{B^*} = \left| I^*_4 + \frac{|4A + x - (r_4 + r_5 + 2l_4)|_B}{A} \right|_{B^*} = \left| 2 + \frac{|40 - 7|_{18}}{3} \right|_6 = 1\,, \\
I^*_{5'} &= |I^*_{4'} + \Delta I^*_{4'}|_{B^*} = \left| I^*_{4'} + \frac{|4A + x - (l_4 + l_5 + 2r_5)|_B}{A} \right|_{B^*} = \left| 2 + \frac{|40 - 7|_{18}}{3} \right|_6 = 1\,, \\
I^*_6 &= |I^*_5 + \Delta I^*_5|_{B^*} = \left| I^*_5 + \frac{|4A + x - (r_5 + r_6 + 2l_5)|_B}{A} \right|_{B^*} = \left| 1 + \frac{|40 - 7|_{18}}{3} \right|_6 = 0\,, \\
I^*_{6'} &= |I^*_{5'} + \Delta I^*_{5'}|_{B^*} = \left| I^*_{5'} + \frac{|4A + x - (l_5 + l_6 + 2r_6)|_B}{A} \right|_{B^*} = \left| 1 + \frac{|40 - 7|_{18}}{3} \right|_6 = 0\,, \\
I^*_7 &= |I^*_6 + \Delta I^*_6|_{B^*} = \left| I^*_6 + \frac{|4A + x - (r_6 + r_7 + 2l_6)|_B}{A} \right|_{B^*} = \left| 0 + \frac{|40 - 10|_{18}}{3} \right|_6 = 4\,, \\
I^*_{7'} &= |I^*_{6'} + \Delta I^*_{6'}|_{B^*} = \left| I^*_{6'} + \frac{|4A + x - (l_6 + l_7 + 2r_7)|_B}{A} \right|_{B^*} = \left| 0 + \frac{|40 - 10|_{18}}{3} \right|_6 = 4\,, \\
I^*_8 &= |I^*_7 + \Delta I^*_7|_{B^*} = \left| I^*_7 + \frac{|4A + x - (r_7 + r_8 + 2l_7)|_B}{A} \right|_{B^*} = \left| 4 + \frac{|40 - 7|_{18}}{3} \right|_6 = 3\,, \\
I^*_{8'} &= |I^*_{7'} + \Delta I^*_{7'}|_{B^*} = \left| I^*_{7'} + \frac{|4A + x - (l_7 + l_8 + 2r_8)|_B}{A} \right|_{B^*} = \left| 4 + \frac{|40 - 7|_{18}}{3} \right|_6 = 3\,, \\
I^*_9 &= |I^*_8 + \Delta I^*_8|_{B^*} = \left| I^*_8 + \frac{|4A + x - (r_8 + r_9 + 2l_8)|_B}{A} \right|_{B^*} = \left| 3 + \frac{|40 - 7|_{18}}{3} \right|_6 = 2\,, \\
I^*_{9'} &= |I^*_{8'} + \Delta I^*_{8'}|_{B^*} = \left| I^*_{8'} + \frac{|4A + x - (l_8 + l_9 + 2r_9)|_B}{A} \right|_{B^*} = \left| 3 + \frac{|40 - 7|_{18}}{3} \right|_6 = 2\,, \\
I^*_{10} &= I^*_0 = 0\,.
\end{aligned}
$$

The I^*_R and I^*_L values have been entered on the first-return string-run diagram of one string at the upper-right in Fig. 972.

We can now assemble the half-cycle pattern (this and its use is fully discussed in *The Braider*, Issues No. 28 and No. 29; it is the diagram immediately below the first-return string-run diagrams in Fig. 972). The number of crossings on a half-cycle is calculated with the formula $2A + x - 1 - (r_i + l_i)$ for a half-cycle which runs from lower right bight-boundary r_i to upper left bight-boundary l_i. Similarly the number of crossings on a half-cycle which runs from lower left bight-boundary l_i to upper right bight-boundary r_i is calculated with the formula $2A + x - 1 - (l_i + r_i)$.

From the half-cycle pattern we derive the half-cycle tables in Fig. 973 (see the above mentioned issues of *The Braider*, however, in those issues we have limited ourselves to series braiding, which would in this case mean that we first complete the braiding of essential string No. 1, and after that we braid essential string No. 2; we would then call the first half-cycle of essential string No. 2 **half-cycle 19** (since the knot has 18 bights and hence 36 half-cycles in total) and keep numbering the following halfcycles of essential string No. 2 upwards).



2	16	12	14	10	6	8	4	18	2	16	12	14	10	6	8	4	18			
8	4	18	2	16	12	14	10	6	8	4	18	2	16	12	14	10	6			
14	10	6	8	4	18	2	16	12	14	10	6	8	4	18	2	16	12			
u	o	o	o	u	u	u	o	o	o	u	u	u	o	o	o	u	u	2	14	8
u	u	o	o	o	u	u	u	o	o	o	u	u	u	o	o	o	u	16	10	4
u	u	u	o	o	o	u	u	u	o	o	o	u	u	u	o	o	o	12	6	18

11	15	☒	5	9	13	17	3	7	11	15	☒	5	9	13	17	3	7			
17	3	7	11	15	☒	5	9	13	17	3	7	11	15	☒	5	9	13			
5	9	13	17	3	7	11	15	☒	5	9	13	17	3	7	11	15	☒			
u	u	o	o	o	u	u	u	o	o	o	u	u	u	o	o	o	u	1	13	7
u	o	o	o	u	u	u	o	o	o	u	u	u	o	o	o	u	u	15	9	3
o	o	o	u	u	u	o	o	o	u	u	u	o	o	o	u	u	u	11	5	17

Fig. 973 — Half-cycle tables for $m = 2$.

Since we have 2 essential strings which are parallel braided, we don't need the complete half-cycle tables (a half-cycle table consists of four compartments: an upper-left compartment, a lower-left compartment, an upper-right compartment and a lower-right compartment). A complete half-cycle table has:

in the upper-left compartment B^* rows and a number of columns equal to the maximum number of crossings on the half-cycles it is associated with,

in the lower-left compartment A rows and a number of columns equal to those in the upper-left compartment,

in the lower-right compartment a number of rows equal to those in the lower-left compartment and a number of columns equal to the number of rows in the upper-left compartment.

the upper-right compartment couples the rows in the upper-left compartment with the columns in the lower-right compartment.

Hence in our case, the complete half-cycle table for the odd-numbered half-cycles (from lower-right to upper-left) has in the upper-left compartment $B^* = 6$ rows and 29 columns, in the lower-left compartment $A = 3$ rows and 29 columns, in the lower-right compartment 3 rows and 6 columns; the complete half-cycle table for the even-numbered half-cycles (from lower-left to upper-right) has in the upper-left compartment $B^* = 6$ rows and 30 columns, in the lower-left compartment $A = 3$ rows and 30 columns, in the lower-right compartment 3 rows and 6 columns.

Say we have m strings in the string-set and we braid these by the parallel braiding method. Then in their half-cycle tables we only need:

in their upper-left compartments $\frac{B^*}{m}$ rows and $\frac{2B}{m}$ columns,

in their lower-left compartments A rows and $\frac{2B}{m}$ columns,

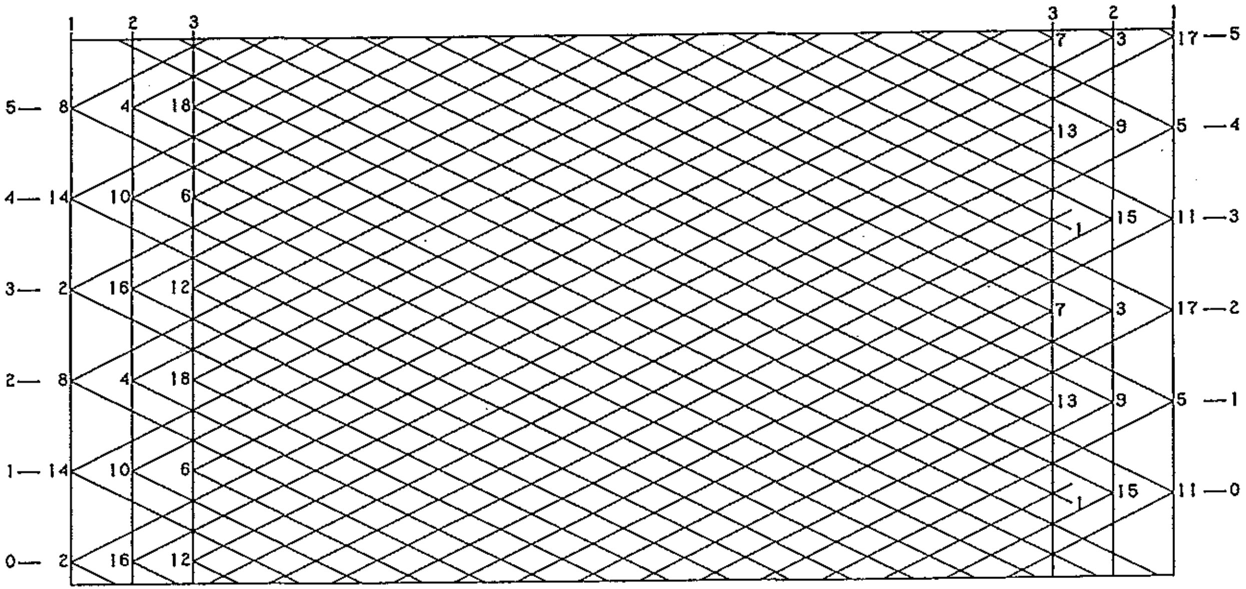
in their lower-right compartments A rows and $\frac{B^*}{m}$ columns.

Hence in our case for the parallel braiding of $m = 2$ strings, the half-cycle tables require in their upper-left compartments $\frac{B^*}{m} = \frac{6}{2} = 3$ rows and $\frac{2B}{m} = \frac{36}{2} = 18$ columns, in their lower-left compartments $A = 3$ rows and $\frac{2B}{m} = 18$ columns, and in their lower-right compartments $A = 3$ rows and $\frac{B^*}{m} = 3$ columns. To ensure that we obtain the correct number of crossings for half-cycles specified by a row in the lower-right compartment we repeat the crossing-sequence obtained from the lower-left compartment in that row so that we obtain this sequence the number of times indicated on the right of the table concerned and repeat the crossing-sequence obtained in the lower-left compartment in that row once again until the bold vertical line has been reached.

Hence from these half-cycle tables in Fig. 973 we read the following half-cycle braiding algorithms:

half-cycle 1 : $R_3 \longrightarrow L_1$: Free run.
half-cycle 2 : $L_1 \longrightarrow R_2$: $u\,|\,o \longrightarrow$
$u - o - u\,.$
half-cycle 3 : $R_2 \longrightarrow L_2$: $o\,|\,u \longrightarrow$
$o - u - o\,.$
half-cycle 4 : $L_2 \longrightarrow R_1$: $u\,u\,o\,|\,o \longrightarrow$
$2u - 2o - 2u - o\,.$
half-cycle 5 : $R_1 \longrightarrow L_3$: $o\,o\,u\,|\,u \longrightarrow$
$2o - 2u - 2o - u\,.$
half-cycle 6 : $L_3 \longrightarrow R_3$: $u\,o\,u\,|\,o\,u\,o \longrightarrow$
$u - o - u - o - u - o - u - o - u\,.$
half-cycle 7 : $R_3 \longrightarrow L_1$: $o\,u\,o\,|\,u\,o\,u \longrightarrow$
$o - u - o - u - o - u - o - u - o\,.$
half-cycle 8 : $L_1 \longrightarrow R_2$: $u\,u\,u\,o\,o\,|\,o\,o\,u \longrightarrow$
$3u - 4o - 4u - 2o\,.$
half-cycle 9 : $R_2 \longrightarrow L_2$: $o\,o\,u\,o\,u\,|\,u\,o\,u \longrightarrow$
$2o - u - o - 2u - o - u - 2o - u - o - u\,.$
half-cycle 10 : $L_2 \longrightarrow R_1$: $u\,u\,o\,u\,o\,o\,o\,|\,u\,o\,u \longrightarrow$
$2u - o - u - 3o - u - o - 3u - o - u - 3o\,.$
half-cycle 11 : $R_1 \longrightarrow L_3$: $o\,o\,u\,u\,o\,u\,u\,|\,o\,o\,u \longrightarrow$
$2o - 2u - o - 2u - 2o - u - 2o - 2u - o - 2u\,.$
half-cycle 12 : $L_3 \longrightarrow R_3$: $u\,u\,o\,o\,u\,u\,|\,o\,o\,u\,u\,o\,o \longrightarrow$
$2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - 2u\,.$
half-cycle 13 : $R_3 \longrightarrow L_1$: $u\,o\,o\,u\,u\,o\,o\,|\,u\,u\,o\,o\,u \longrightarrow$
$u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o\,.$
half-cycle 14 : $L_1 \longrightarrow R_2$: $u\,o\,o\,u\,u\,o\,o\,o\,u\,|\,u\,o\,o\,u\,u \longrightarrow$
$u - 2o - 2u - 3o - 2u - 2o - 3u - 2o - 2u - 3o - u\,.$
half-cycle 15 : $R_2 \longrightarrow L_2$: $u\,o\,o\,u\,u\,u\,o\,o\,u\,|\,u\,o\,o\,o\,u \longrightarrow$
$u - 2o - 3u - 2o - 2u - 3o - 2u - 2o - 3u - 2o - u\,.$
half-cycle 16 : $L_2 \longrightarrow R_1$: $u\,u\,o\,o\,o\,u\,u\,o\,o\,o\,u\,|\,u\,u\,o\,o\,u \longrightarrow$
$2u - 3o - 2u - 3o - 3u - 2o - 3u - 3o - 2u - 3o - u\,.$
half-cycle 17 : $R_1 \longrightarrow L_3$: $o\,o\,u\,u\,u\,o\,o\,o\,u\,u\,|\,o\,o\,o\,u\,u\,u \longrightarrow$
$2o - 3u - 3o - 2u - 3o - 3u - 2o - 3u - 3o - 2u\,.$
half-cycle 18 : $L_3 \longrightarrow R_3$: $u\,u\,u\,o\,o\,o\,u\,u\,u\,|\,o\,o\,o\,u\,u\,u\,o\,o\,o \longrightarrow$
$3u - 3o - 3u - 3o - 3u - 3o - 3u - 3o - 3u\,.$

These sequential braiding steps are shown on pp. 1234 - 1239.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3— 2
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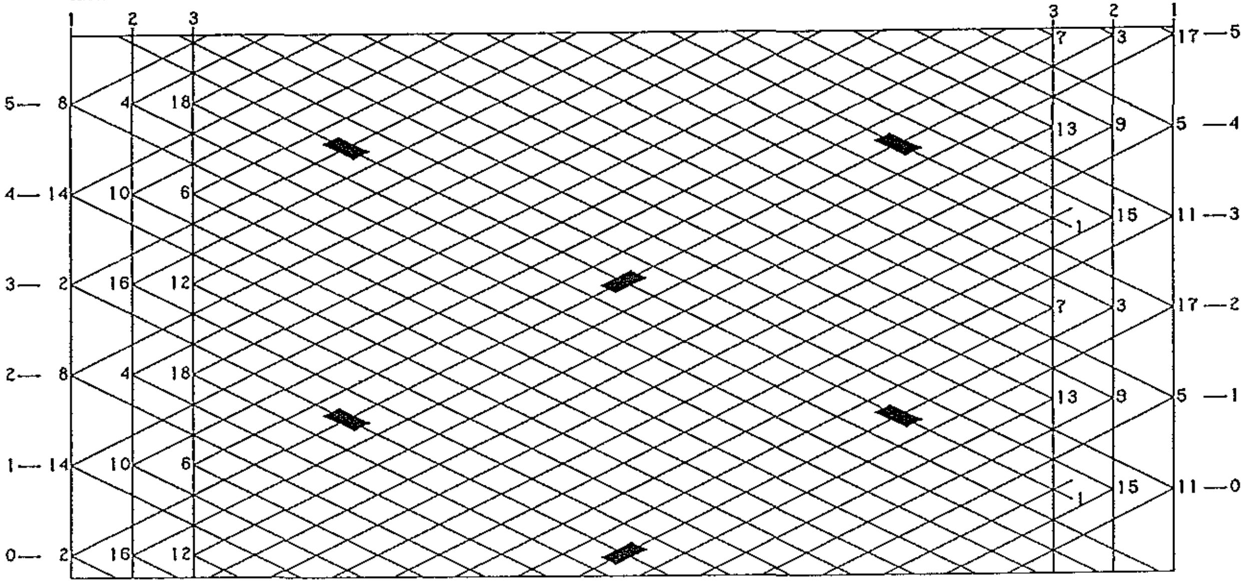
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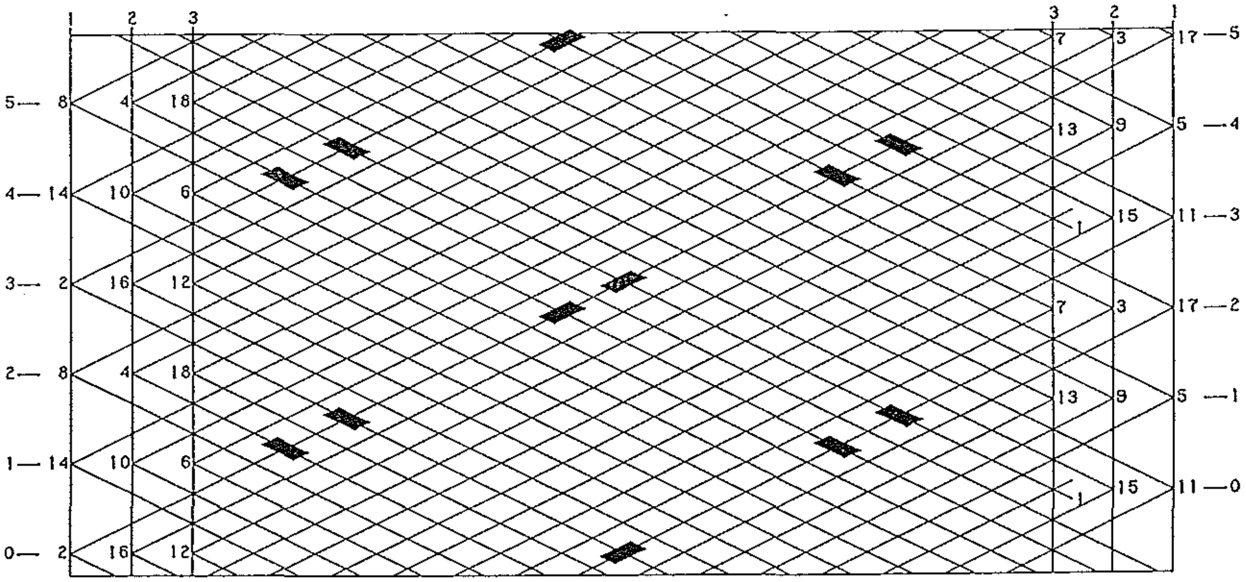
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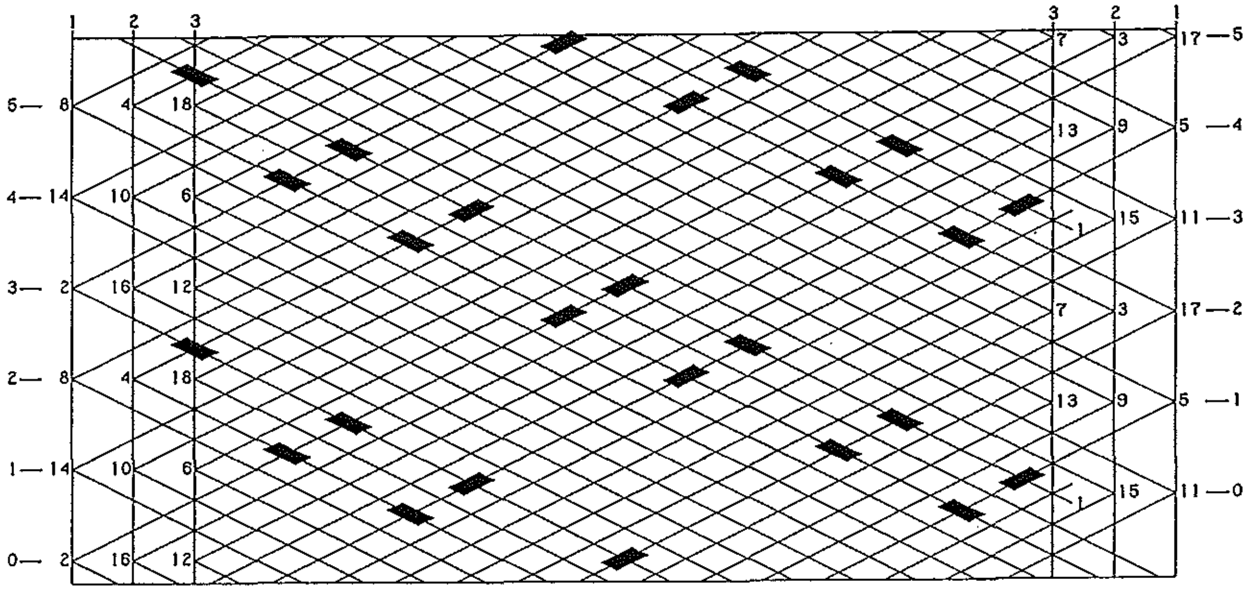
17 —2
5 —1
11 —0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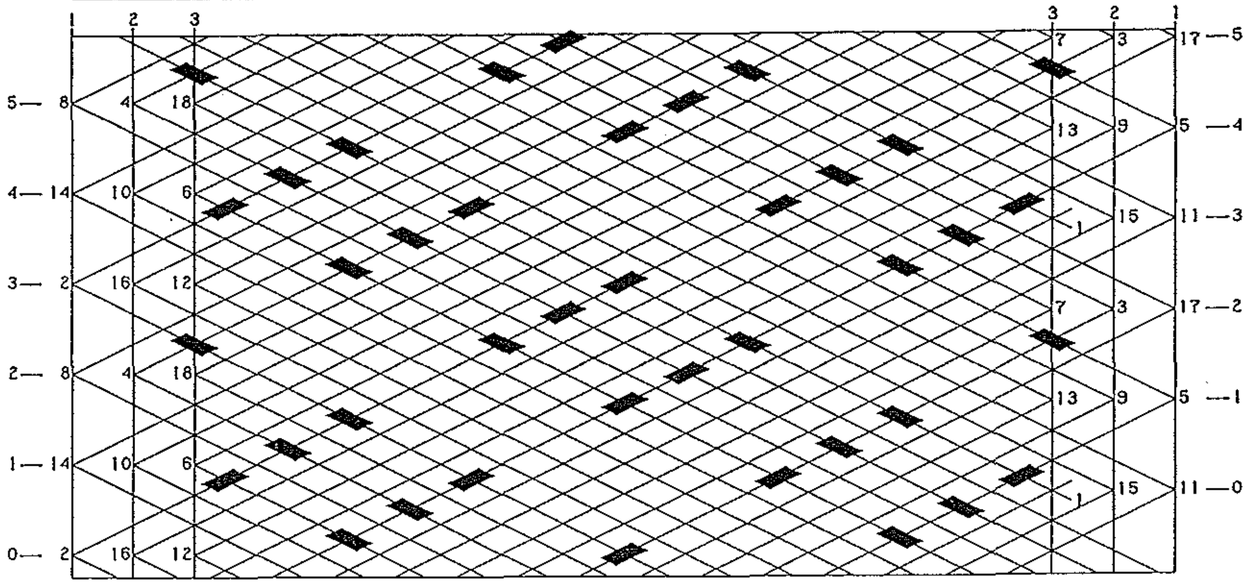
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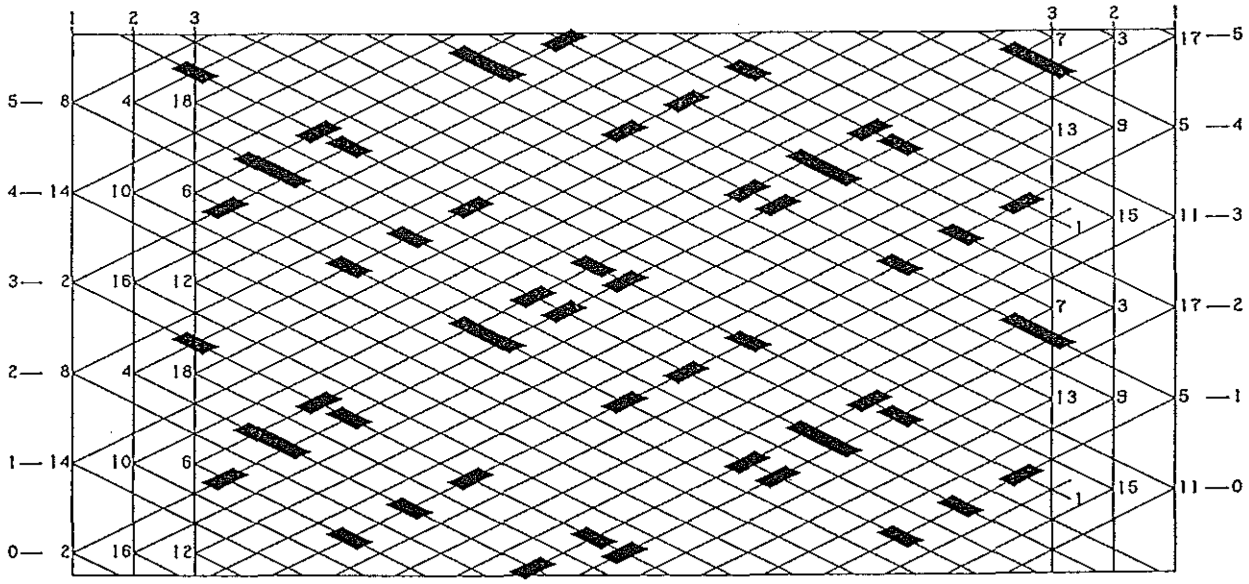
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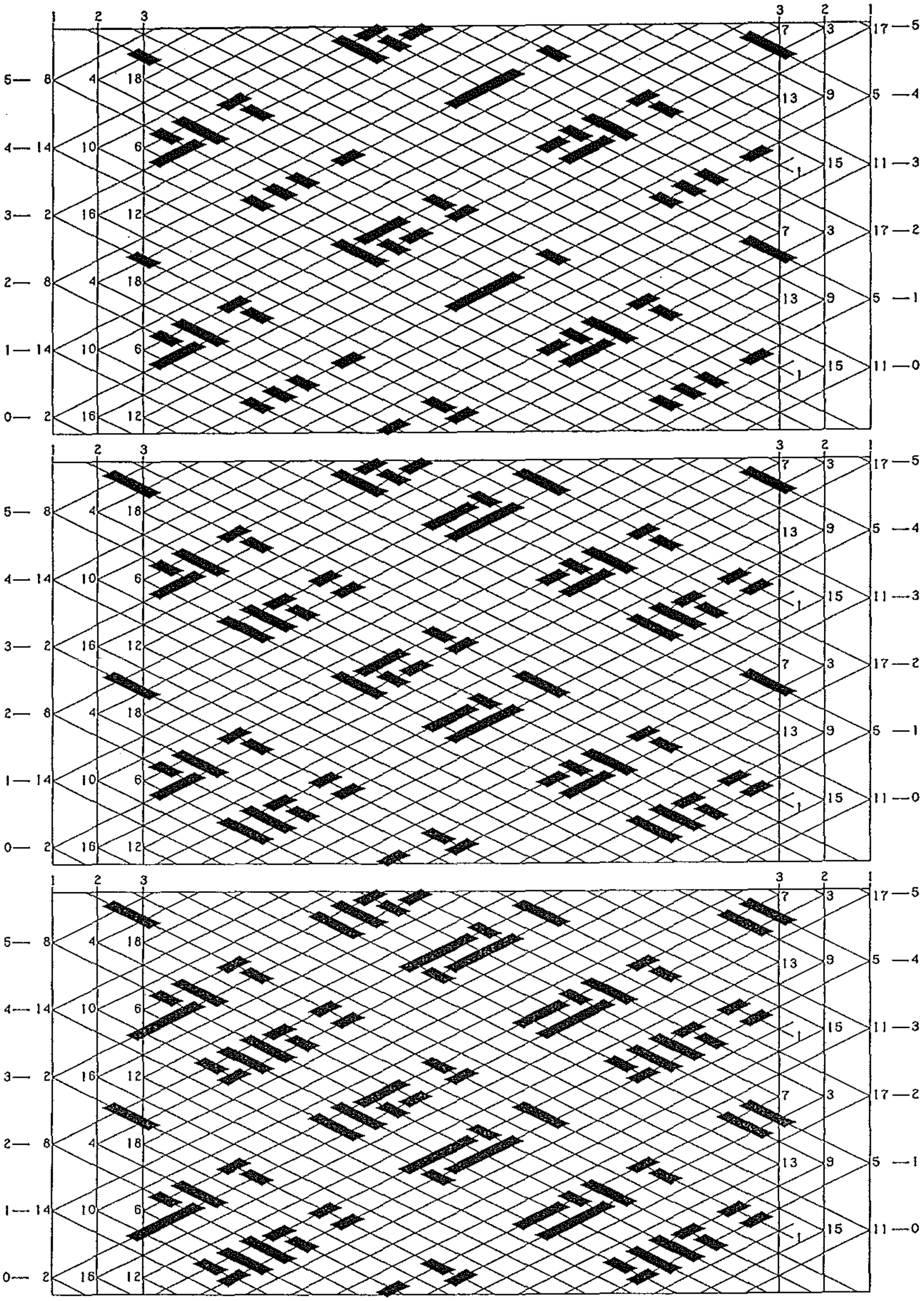
5 —1
11 —0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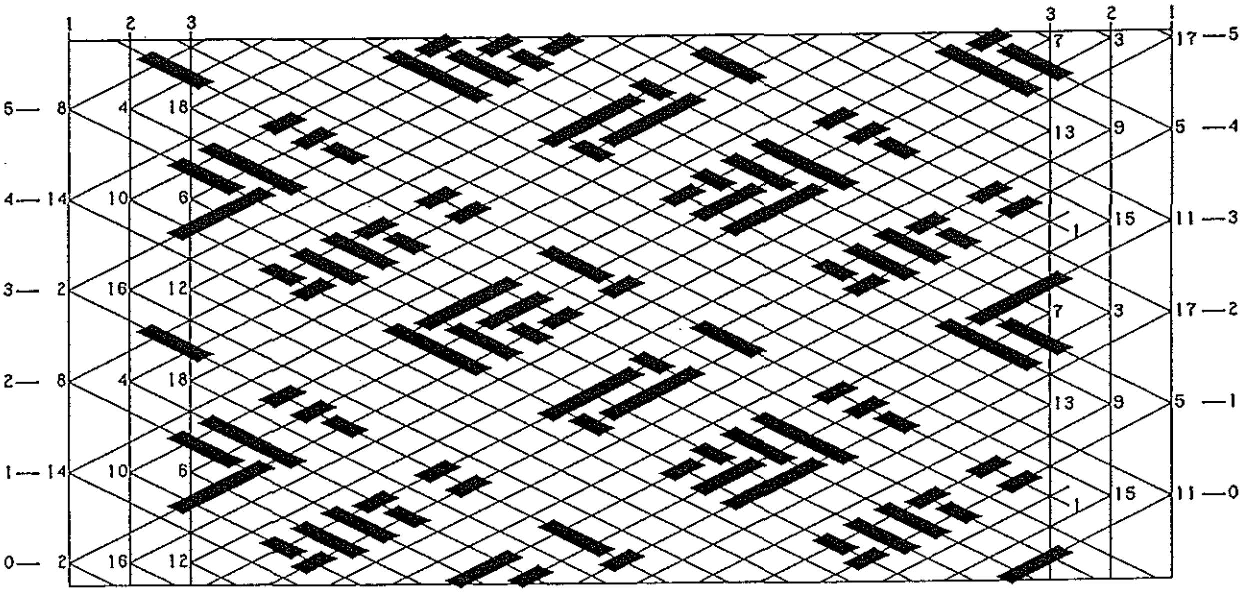
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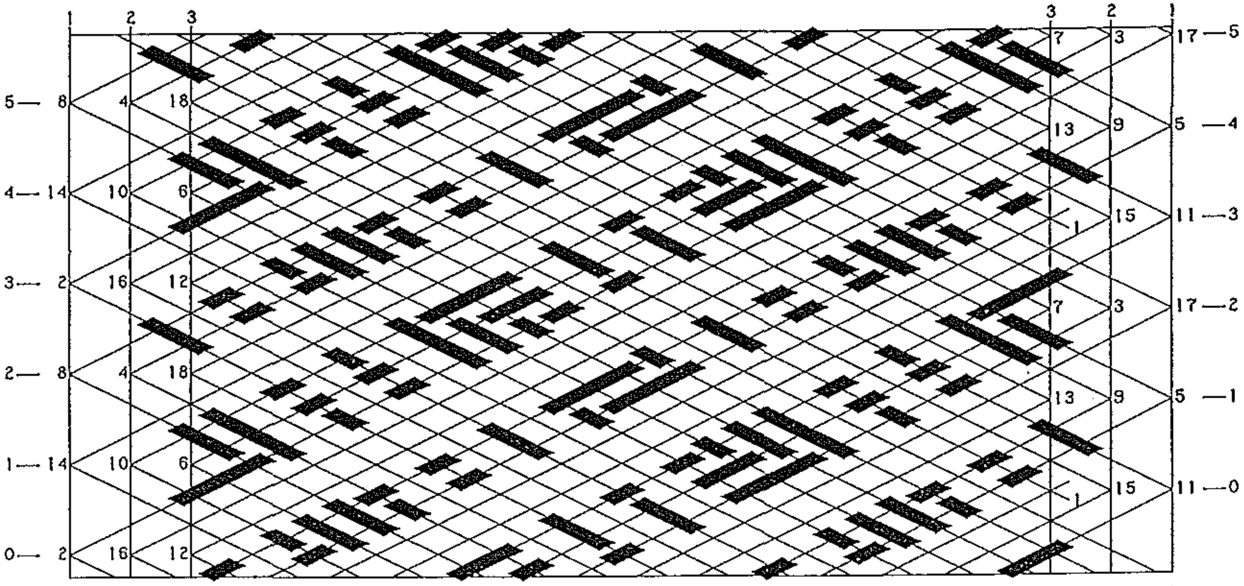
3 2 1
5— 8 4 18
4— 14 10 6
3— 2 16 12
2— 8 4 18
1— 14 10 6
0— 2 16 12
7 3 17 —5
13 9 5 —4
1 15 11 —3
7 3 17 —2
13 9 5 —1
1 15 11 —0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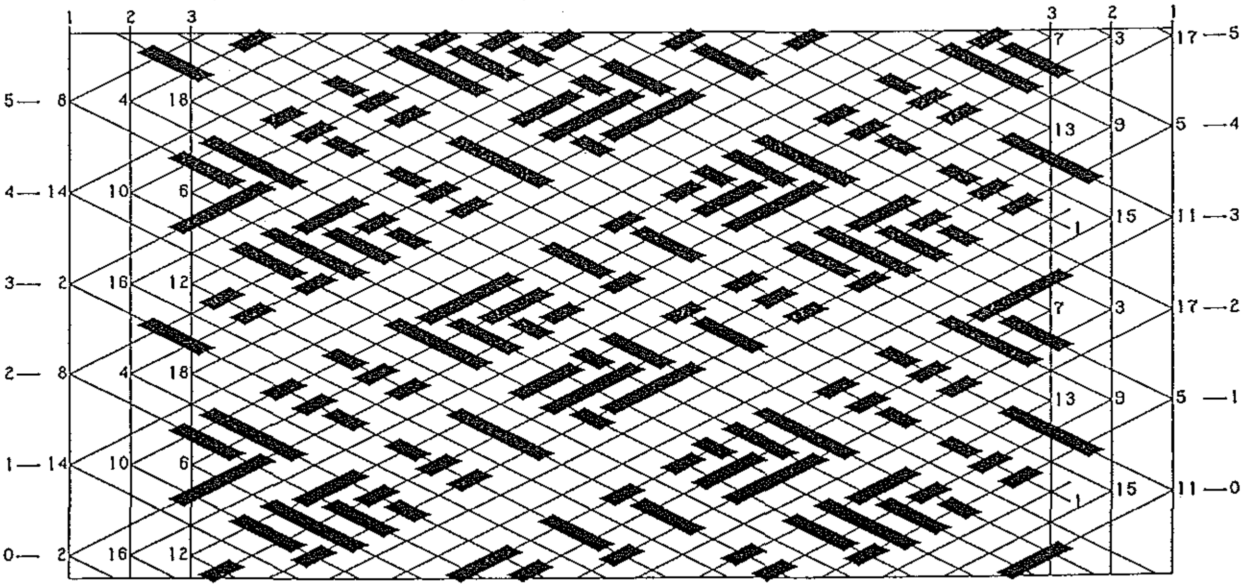
1 15 11 —0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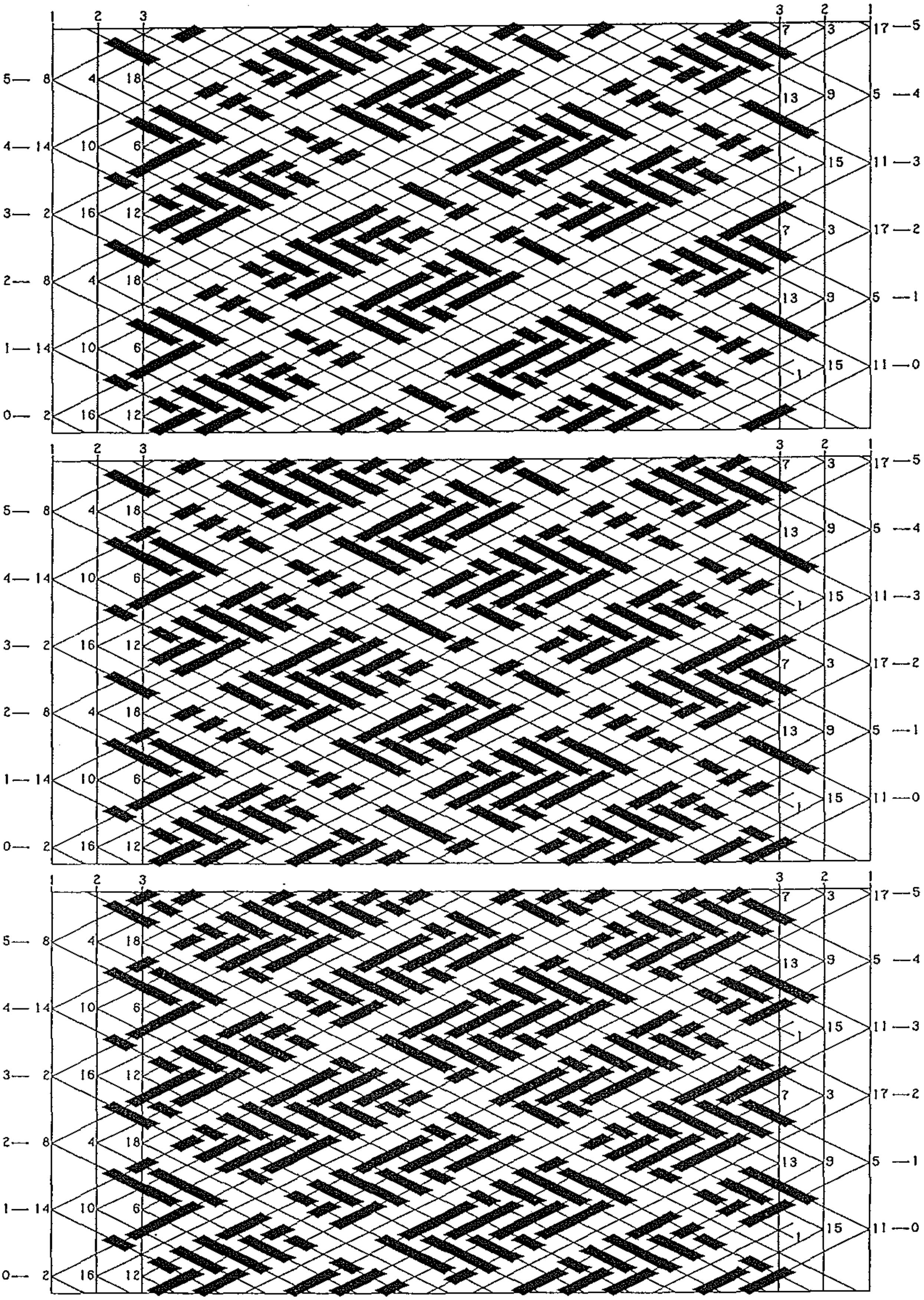
13 9 5 —1
1 15 11 —0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1 15 11—3
7 3 17—2
13 9 5 —1
1 15 11—0
1 2 3 3 2 1
5— 8 4 18
4— 14 10 6
3— 2 16 12
2— 8 4 18
1— 14 10 6
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7 3 17—5
13 9 5 —4
1 15 11—3
7 3 17—2
13 9 5 —1
1 15 11—0
1 2 3 3 2 1
5— 8 4 18
4— 14 10 6
3— 2 16 12
2— 8 4 18
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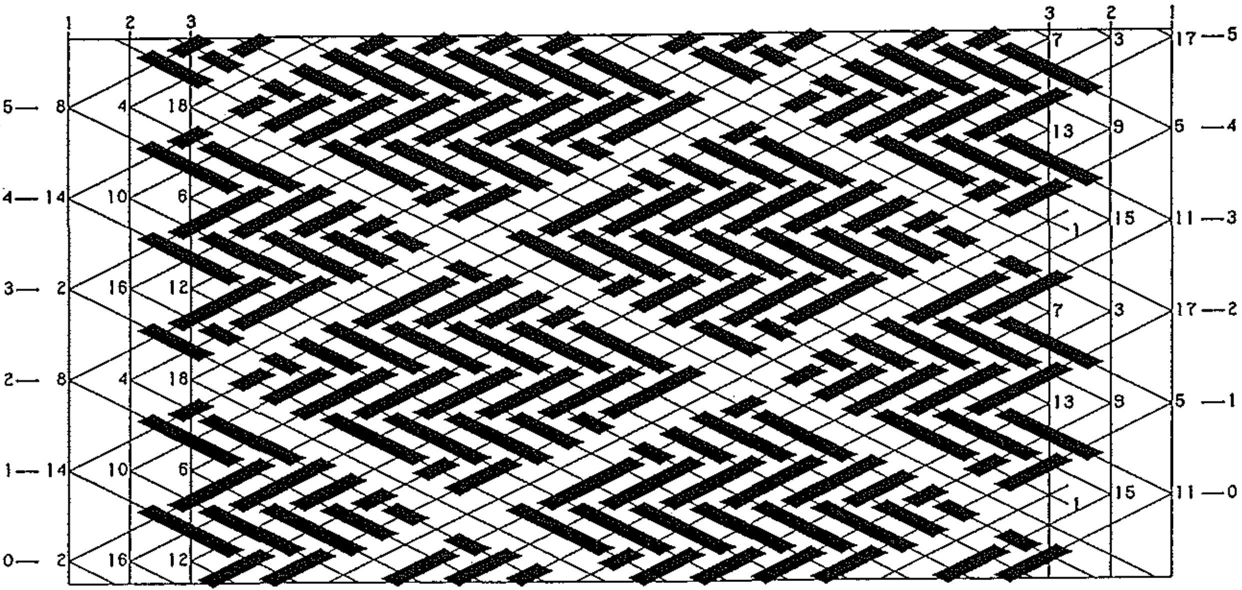
7 3 17—2
13 9 5 —1
1 15 11—0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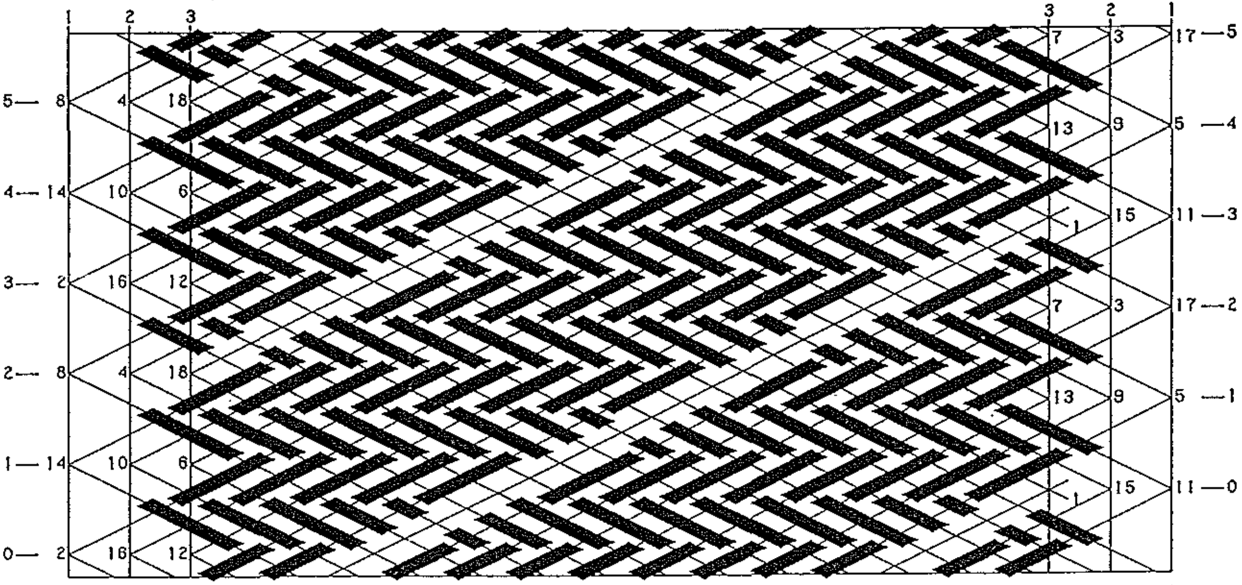
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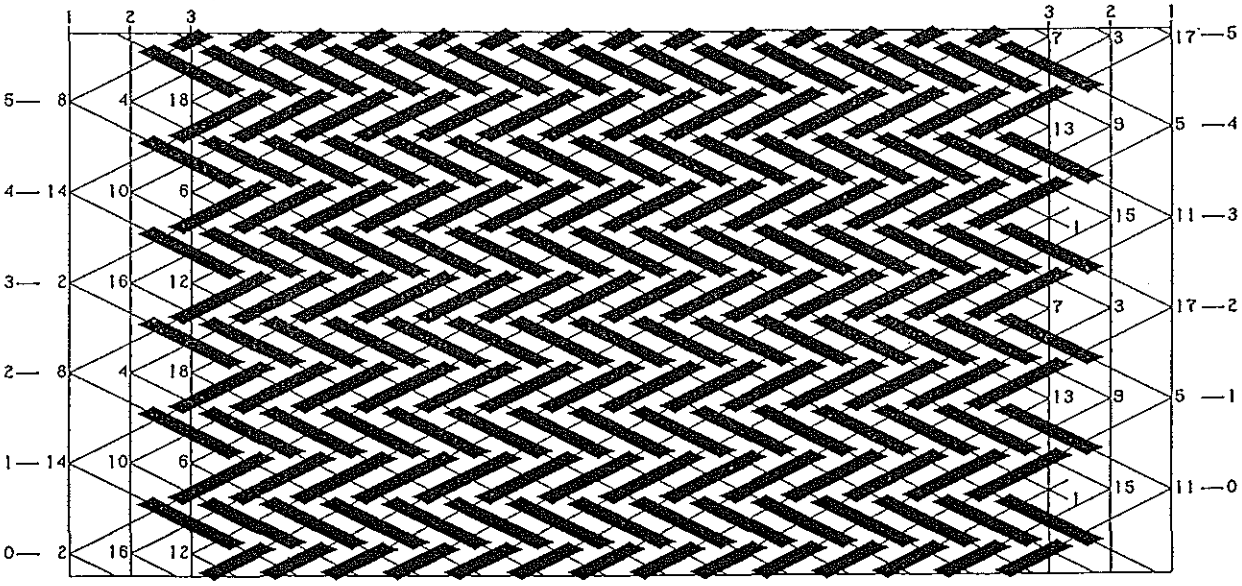
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0— 2
17—5
5 —4
11—3
17—2
5 —1
11—0

Now let's say that instead of using the 2 essential strings, we use 6 strings (hence $m = 6$). The associated half-cycle tables will then have in their upper-left compartments $\frac{B^*}{m} = \frac{6}{6} = 1$ row and $\frac{2B}{m} = \frac{36}{6} = 6$ columns, in their lower-left compartments $A = 3$ rows and $\frac{2B}{m} = 6$ columns, and in their lower-right compartments $A = 3$ rows and $\frac{B^*}{m} = 1$ column. To ensure that we obtain the correct number of crossings for half-cycles specified by a row in the lower-right compartment we repeat the crossing-sequence obtained from the lower-left compartment in that row so that we obtain this sequence the number of times indicated on the right of the table concerned and repeat the crossing-sequence obtained in the lower-left compartment in that row once again until the bold vertical line has been reached.

The associated first-return string-run of a string and the half-cycle pattern of the six strings are depicted in Fig. 974.

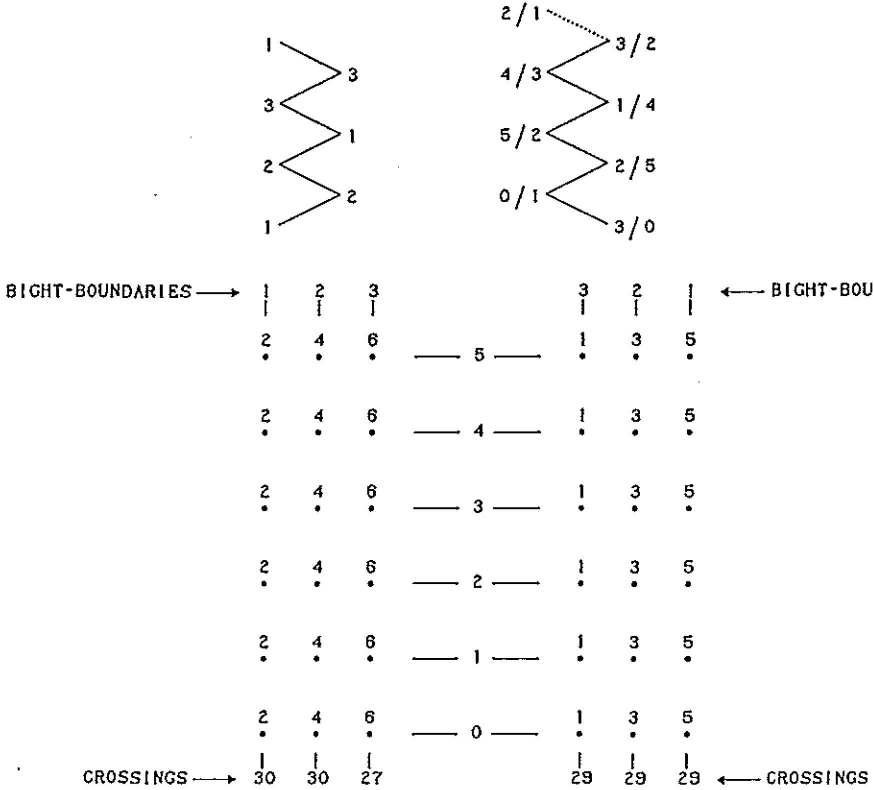
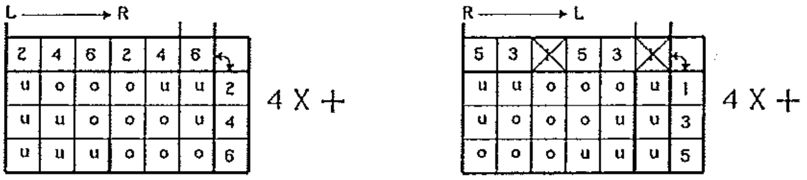


Fig. 974 — First-return string-run of one string and half-cycle pattern for $m = 6$.

From this half-cycle pattern in Fig. 974 we obtain the half-cycle tables in Fig. 975.



2	4	6	2	4	6	↷
u	o	o	o	u	u	2
u	u	o	o	o	u	4
u	u	u	o	o	o	6

5	3	~~1~~	5	3	~~1~~	↷
u	u	o	o	o	u	1
u	o	o	o	u	u	3
o	o	o	u	u	u	5

Fig. 975 — Half-cycle tables for $m = 6$.

Hence from the half-cycle tables in Fig. 975 we read the following half-cycle braiding algorithms for parallel braiding the six strings:

half-cycle 1 : $R_3 \longrightarrow L_1$: Free run.

half-cycle 2 : $L_1 \longrightarrow R_2$: $u\ o\,| \longrightarrow$

$$u - o - u - o - u - o - u - o - u - o\,.$$

half-cycle 3 : $R_2 \longrightarrow L_2$: $o\,u\,| \longrightarrow$
$o - u - o - u - o - u - o - u - o - u\,.$
half-cycle 4 : $L_2 \longrightarrow R_1$: $u\,u\,o\,o\,| \longrightarrow$
$2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o\,.$
half-cycle 5 : $R_1 \longrightarrow L_3$: $o\,o\,u\,u\,| \longrightarrow$
$2o - 2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - 2u\,.$
half-cycle 6 : $L_3 \longrightarrow R_3$: $u\,u\,u\,|\,o\,o\,o \longrightarrow$
$3u - 3o - 3u - 3o - 3u - 3o - 3u - 3o - 3u\,.$

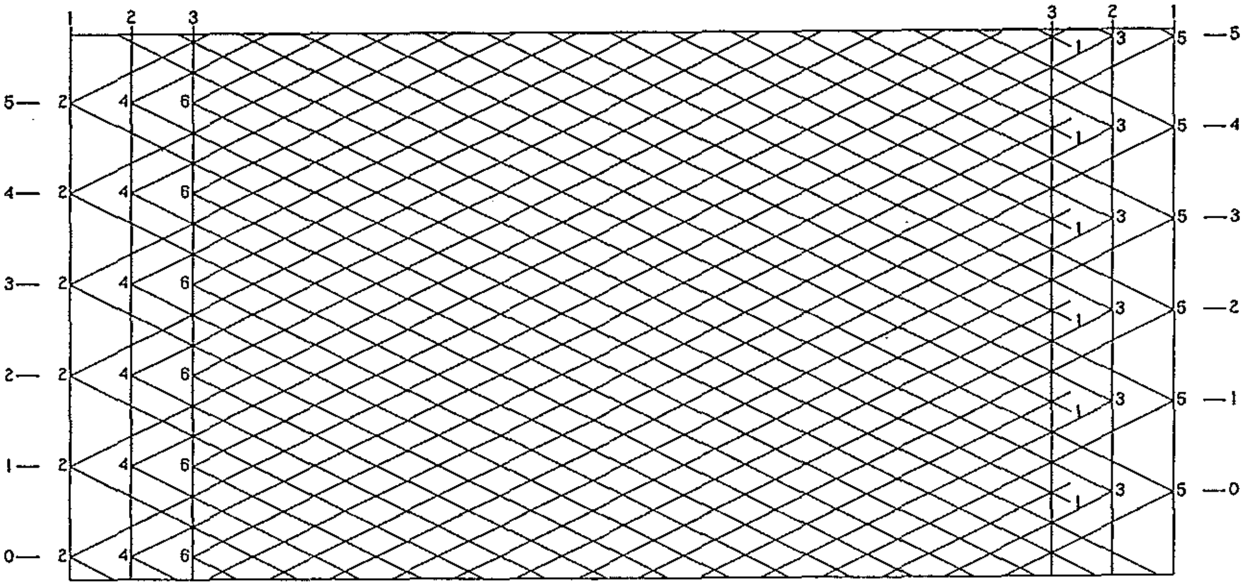
These sequential braiding steps are shown on pp. 1242 - 1243.

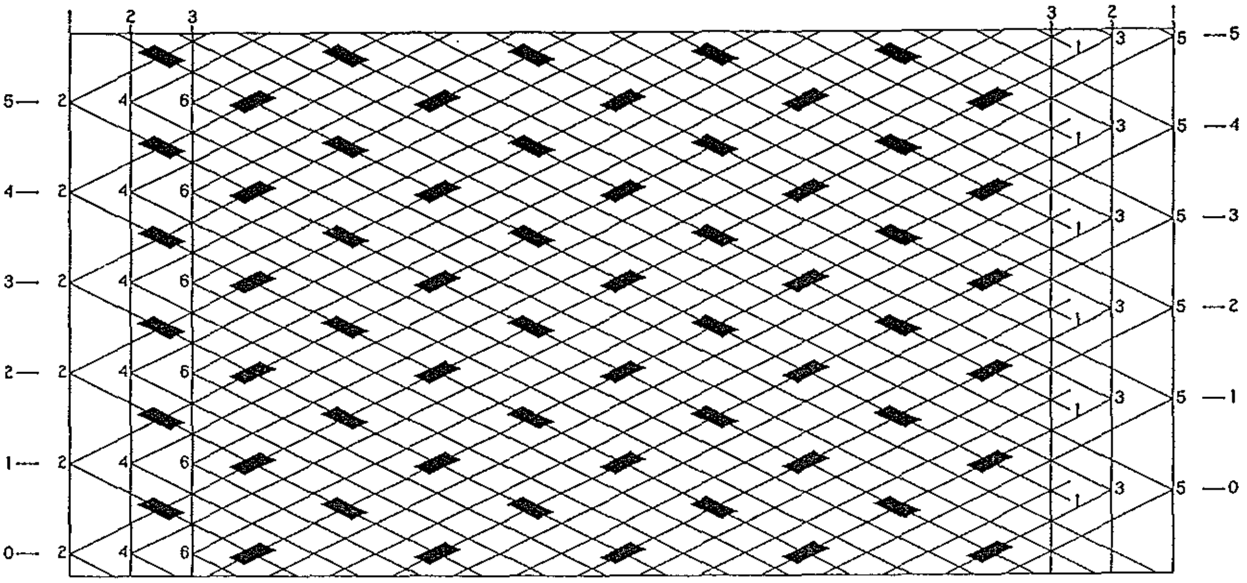
Compare these two construction procedures — both are simple parallel braiding methods, but the method with $m = 2$ requires **four** string-ends to be worked away, while the method with $m = 6$ requires **twelve** string-ends to be worked away, hence 3× as many!!! Of course, the $m = 6$ approach is faster but the craftsmanship is much poorer!!! In fact, the $m = 6$ approach is the approach of novice braiders or mass-producers. Unfortunately most braiders belong to their ranks while most customers wouldn't be able to tell the difference between the knot whose foundation knot is produced with $m = 2$ and the knot whose foundation knot is produced with $m = 6$. But — quality leads to better prices and a better reputation in the commercial and especially in the collectors world (a Rolls Royce can demand a better price than a Toyota; sure, some are quite satisfied in producing Toyotas, and many are quite happy to purchase them, but those with plenty of lolly certainly go for the Rolls Royces, not the Toyotas). We have shown how the novice gets caught out by the type of work he produces, while a faker, who knows what braiding is about, would surely have taken say $l_h = 14$, $r_h = 15$ or $l_h = 15$, $r_h = 14$ and use $m = 6$). Mind you a buyer who knows his beans and does the few simple mental calculations required, can readily discover whether or not it might be a fake and obviously will look for any telltales in that direction, and such telltales are extremely difficult, if not impossible to hide completely.

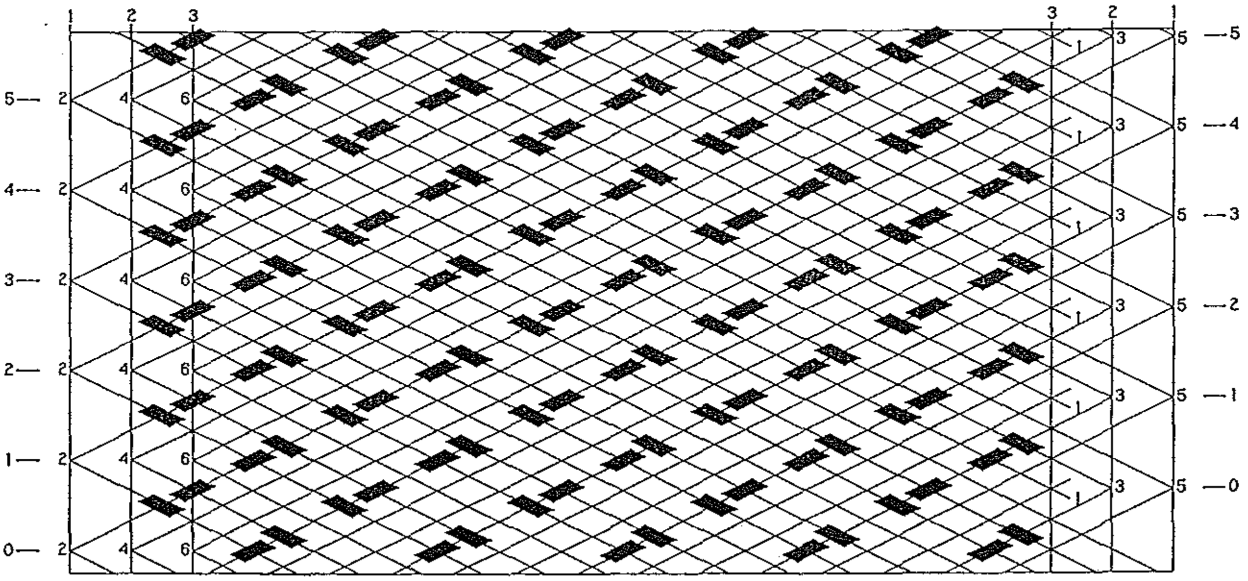
The braider who did send us the computer colour print-out of his scanned picture of the knot he braided on his quirt handle was apparently not aware of what he really was doing since he was under the impression that when he would join in his foundation knot the string-ends of the six strings, he would obtain the string-run of a Perfect Herringbone Pineapple Knot. We know that this is impossible for any Herringbone Pineapple Knot with $A =$ **odd** and $B^* =$ **even**.[†] Only after some letter exchange did he draw the grid-diagram of his foundation knot and discovered his erroneous assumption. A craftsman braider would make sure that he knows what he is producing and hence would not make unfounded assumptions — a simple grid-diagram made by hand on a piece of isometric graph-paper (wich shouldn't take more than 10 minutes at most) would immediately have shown what was going on. It is furthermore not only for the craftsman braider, but also for the buyer of high quality braidwork important to know the role which the l_h and r_h values play, and consequently it is important that they are able to perform a few simple mental calculations.

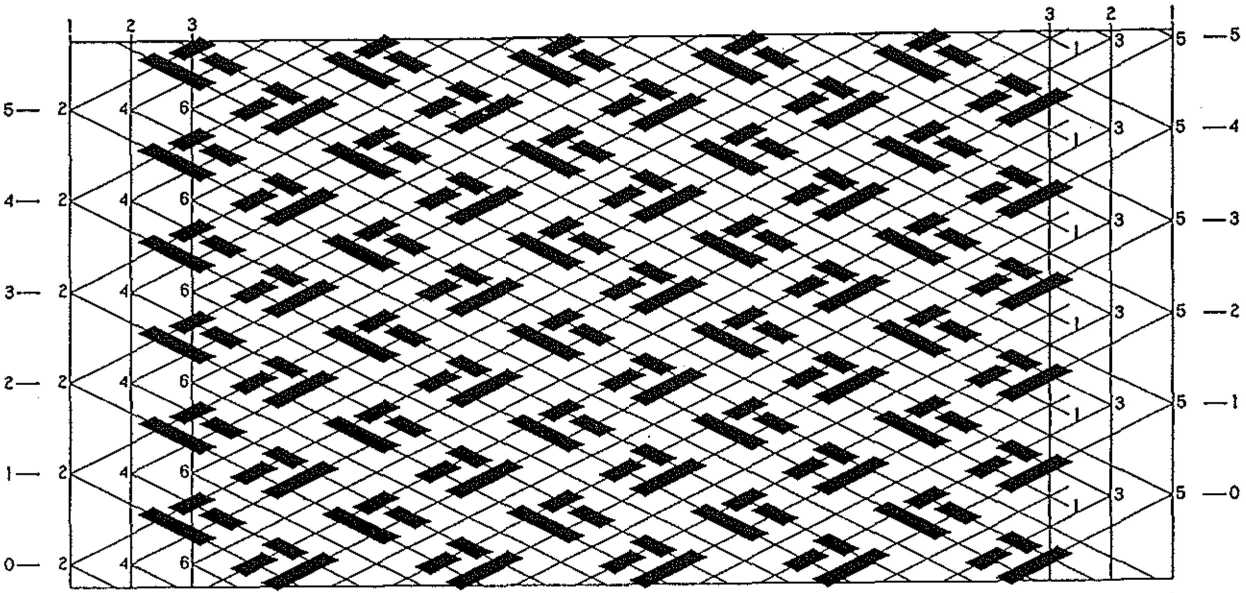
[†] See footnote on pg. 1217. Another way to prove this would be as follows:

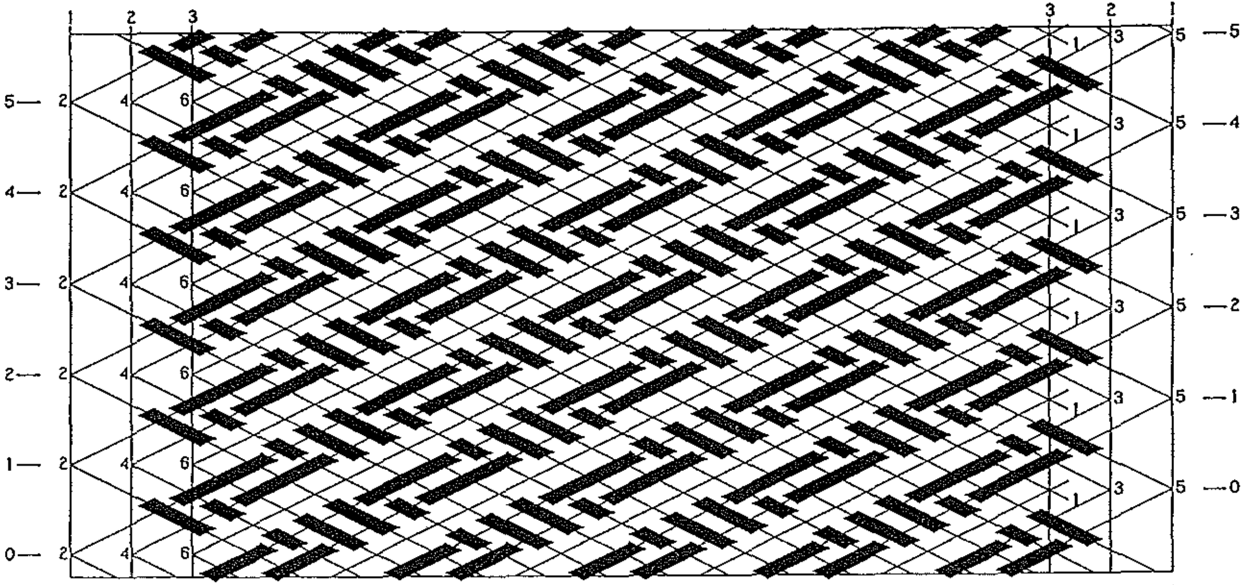
A Standard or a Semi-Standard Herringbone Pineapple Knot will always require more than one string. For a Perfect or a Semi-Perfect Herringbone Pineapple Knot $l_h + r_h =$ **odd**, hence $P_{total} = P = A + l_h + r_h =$ **even** for $A =$ **odd**. Consequently g.c.d.$(P, B^*) \neq 1$ for $B^* =$ **even** and hence we cannot possibly have a Perfect Herringbone Pineapple Knot when $A =$ **odd** and $B^* =$ **even**.

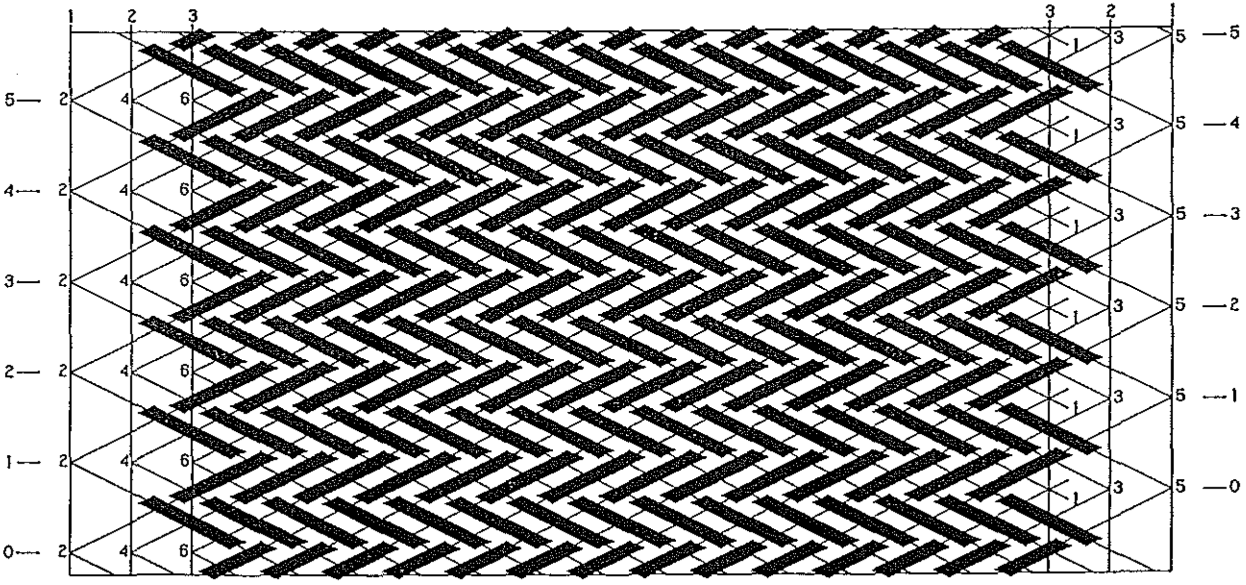

1
2
3
3
2
1
5— 2 4 6
4— 2 4 6
3— 2 4 6
2— 2 4 6
1— 2 4 6
0— 2 4 6
1 3 5 —5
1 3 5 —4
1 3 5 —3
1 3 5 —2
1 3 5 —1
1 3 5 —0


1
2
3
3
2
1
5— 2 4 6
4— 2 4 6
3— 2 4 6
2— 2 4 6
1— 2 4 6
0— 2 4 6
1 3 5 —5
1 3 5 —4
1 3 5 —3
1 3 5 —2
1 3 5 —1
1 3 5 —0


1
2
3
3
2
1
5— 2 4 6
4— 2 4 6
3— 2 4 6
2— 2 4 6
1— 2 4 6
0— 2 4 6
1 3 5 —5
1 3 5 —4
1 3 5 —3
1 3 5 —2
1 3 5 —1
1 3 5 —0


1 2 3 3 2 1
5— 4— 3— 2— 1— 0—
2 4 6
1 3 5
—5 —4 —3 —2 —1 —0


1 2 3 3 2 1
5— 4— 3— 2— 1— 0—
2 4 6
1 3 5
—5 —4 —3 —2 —1 —0


1 2 3 3 2 1
5— 4— 3— 2— 1— 0—
2 4 6
1 3 5
—5 —4 —3 —2 —1 —0

A Sliding Lanyard Knot

The lanyard is made from a six-string $\rightarrow 2u - o \,|\, 2o - u \leftarrow$ round braid[†]. One end of the round braid goes over into a knot through which the other end of the round braid can slide in order to provide an adjustment for the necklace loop of the lanyard.

After forming the necklace loop in the six-string round braid, place its Sliding Knot end on top of the other end and finish the Sliding Knot end as indicated in the sequential diagrams of Fig. 976.

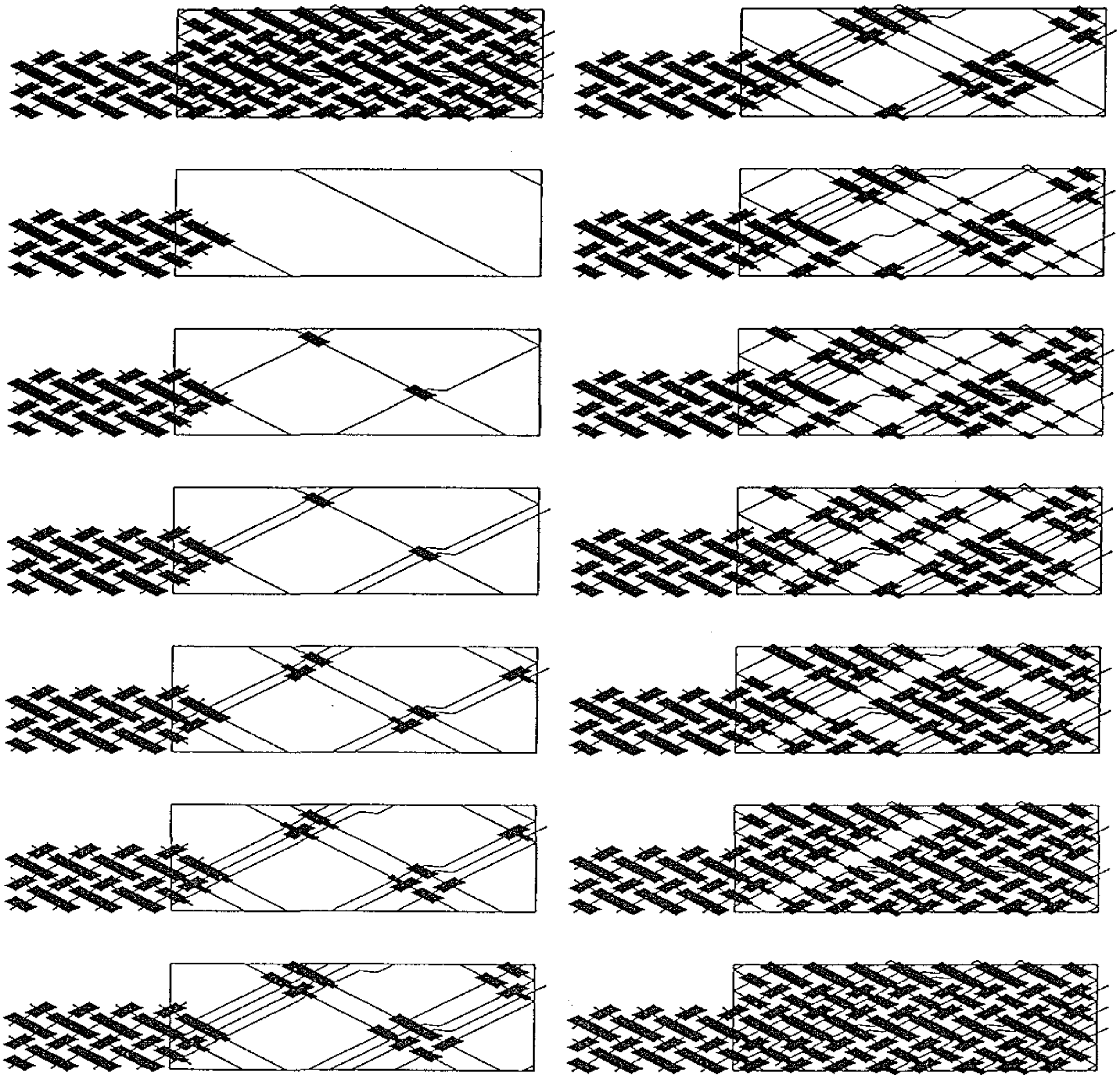


Fig. 976 — A sliding lanyard knot for a six-string $\rightarrow 2u - o \,|\, 2o - u \leftarrow$ round braid.

[†] Refer to *The Braider*, Issue No. 7, pp. 146 - 153.

THE BRAIDER

APPENDIX 2007

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A further note related to Issues No.27, pg.624;
Appendix 2001; No.52, pg.1218 .... *i*

A quarterly publication
for
the braiding artisan

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A further note related to Issues No. 27, pg.624; Appendix 2001; No. 52, pg.1218.

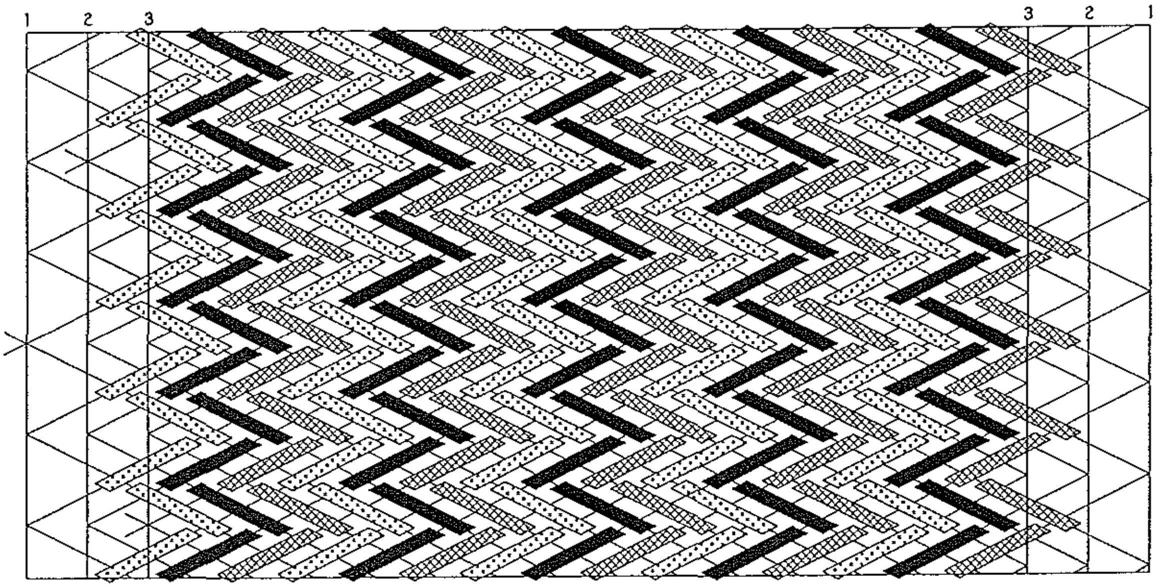
The value V for Standard and Semi-Standard Herringbone Pineapple knots in *The Braider*, Issue No.27, pg.624 is equal to the value for $l_h = r_h$ in *The Braider*, Issue No.52, pg.1218. See also Appendix 2001.

For the Standard and Semi-Standard Herringbone Pineapple Knots we have — — — — when $|l_h|_A = |r_h|_A = 0 \equiv A$. Hence $k = |l_h|_A = |r_h|_A = 0 \equiv A$ and hence $|l_h|_A = |r_h|_A = A$ components with $P_c = 3 + \frac{2l_h - 2A}{A} = 3 + \frac{2r_h - 2A}{A} = 1 + \frac{2l_h}{A} = 1 + \frac{2r_h}{A}$ each.
For these components: $l_i + r_i = k + 1 = A + 1$.

$A - |l_h|_A = A - |r_h|_A = A - A = 0$ components with $P_c = 1 + \frac{2l_h - 2A}{A} = 1 + \frac{2r_h - 2A}{A} = -1 + \frac{2l_h}{A} = -1 + \frac{2r_h}{A}$ each.

$x = l_h + r_h + 2 - A = 2l_h + 2 - A = 2r_h + 2 - A$.

Example: $A = 3$, $l_h = r_h = 15$, $B^* = 6$.
$k = |l_h|_A = |r_h|_A = |15|_3 = 0 =\equiv 3$.
$x = l_h + r_h + 2 - A = 15 + 15 + 2 - 3 = 29$.
Since $l_h = r_h$, we have $A = 3$ components, each of which with $P_c = 1 + \frac{2l_h}{A} = 1 + \frac{2r_h}{A} = 1 + \frac{2 \times 15}{3} = 11$.
g.c.d. $(P_c, B^*) =$ g.c.d. $(11, 6) = 1$, hence the three components do not have sub-components. Thus $\lambda = \gamma = 3$ (three essential strings required).



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A quarterly publication
for
the braiding artisan

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Novice versus Craftsman in the Braiding World

To become a craftsman one has to start at the beginning, hence at the novice level. There is however no guarantee that a novice will become a craftsman. In fact very, very few will ever make it to craftsman level, most will stay at the lowest end of the novice level — the copycat level. In order to gradually progress to craftsman level, the novice must have patience and the real desire to fully understand technical properties of braids. Many might initially have great difficulty in understanding at least some of the technical aspects of braids, but a genuine desire to succeed will eventually overcome this. Everybody first learned to crawl before he/she could walk and first learned to walk before he/she could run. Those who in braiding want to run before they can even crawl will, of course, never reach craftsman level. The *typical braider* is a braider who got stuck at a low novice level; to this category belong most if not all those who advertise themselves as expert braiders who make *Collectable Braided articles.* It should be remembered that there is a great deal more to braiding than being able to cut a nice even and properly bevelled rawhide string for example, which is nothing more than one facet only of good workmanship rather than having anything to do with craftsmanship.

In the previous issue of *The Braider* we discussed the story of a copied knot. We discussed there some items which clearly indicated that the braider concerned got stuck at the novice level. This was subsequently confirmed by not understanding why we had placed the Standing Ends of the six strings of his foundation knot temporarily on right bight-boundary 3.[†] Even a novice soon realises that in good practice the position of the starting point or starting points depends in general on the shape and the coding of the knot in question and hence it would have been obvious why the Standing Ends should temporarely be placed on a right bight-boundary and preferably on right bight-boundary 3 (both considerations are associated with working the string-ends away).

Technical ability is an essential part of craftsmanship. Because of their ignorance it are only the simpletons who think that technical ability and craftsmanship are quite unrelated. It is, however, essential that in order to become a craftsman, a novice must have a genuine desire to master the technical aspects of braiding. Of course, a **desire** to master does not mean to master, in fact none of us might ever be able to master all the technical aspects of braiding since there is still a very great deal indeed to be uncovered. Consequently even the very best craftsman keeps learning and hence any self-proclaimed expert is only an exspurt (ex = has been; spurt = a drip under pressure).

[†] As mentioned on pg. 1241, the braider concerned eventually drew the grid-diagram of his foundation knot ($A = 3$, $B^* = 6$, $l_h = 13$, $r_h = 14$, $x = 26$, $k = 2$, $y = A - 1 = 2$). In this grid-diagram he placed the Standing Ends of the six strings of his foundation knot on left bight-boundary 2. We wrote to him that it would be much better to place them temporarely on right bight-boundary 3. He wrote in reply: *I can not come up for any reason that I can think of, for your suggestion that the standing ends be placed on the right. We of course read from left to right here in the U.S. and I start all my knots from left to right so what is the logic behind placing the starting ends on the right?* If reading from left to right compels one to braid from left to right, one would not be able to progress beyond the first half-cycle since by starting from left to right requires all even numbered half-cycles to be braided from right to left unless the braid gets turned through 180° after the completion of every half-cycle.

A Braiding Project — Key-hanger No. 5

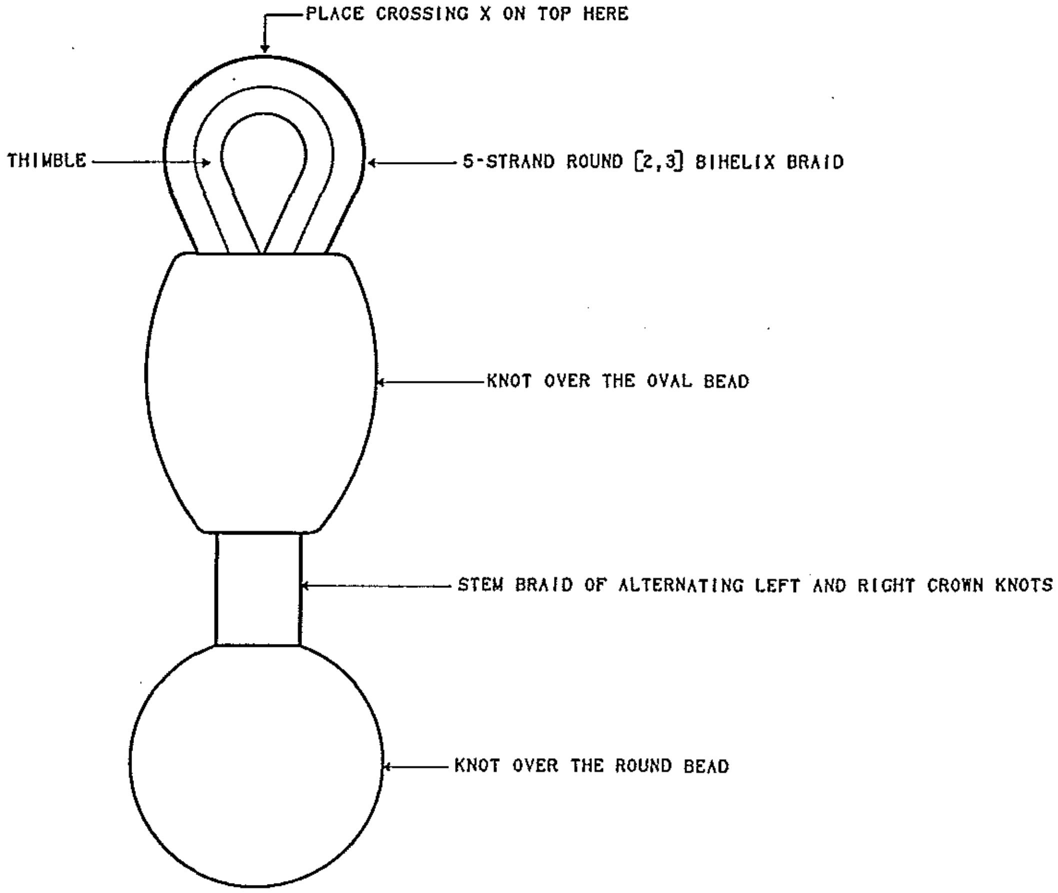
PLACE CROSSING X ON TOP HERE
THIMBLE
5-STRAND ROUND [2,3] BIHELIX BRAID
KNOT OVER THE OVAL BEAD
STEM BRAID OF ALTERNATING LEFT AND RIGHT CROWN KNOTS
KNOT OVER THE ROUND BEAD

Fig. 977 — Key-hanger No. 5. Cord diameter 2 mm.

The braid forming the eye around the thimble of 25 mm. is a 5-cord [2, 3] Round Bihelix Braid made at the centre of the cord lengths (the two red and the two yellow cords are each approximately 60 cm. in length, the blue cord is approximately 30 cm. in length) as shown in Fig. 979 (the colour scheme for the cords is indicated in Fig. 978).

■ STRING COLOUR RED

⬚ STRING COLOUR YELLOW

▨ STRING COLOUR BLUE

Fig. 978 — Colour scheme for the strings.

After this Round Bihelix Braid has been given an anti-clockwise twist of 11.31°[†] (see the bottom right-most grid-diagram in Fig. 979) we place the flattish side of this braid (the two adjacent left-hand columns in the bottom right-most grid-diagram in Fig. 978) in the bottom of the thimble-channel and ensure that crossing X is positioned as indicated in Fig. 977. The braid is put tightly around the thimble and both its 'ends' are secured by a Double Constrictor Knot[‡] immediately below the thimble. The four red and the four yellow cord 'ends' are used for the braid of the stem while for its core the two blue cord 'ends' are used.

[†] Refer to *The Braider*, Issue No. 47, pg. 1114.

[‡] See *The Braider*, Issue No. 47, pg. 1100, Fig. 845.

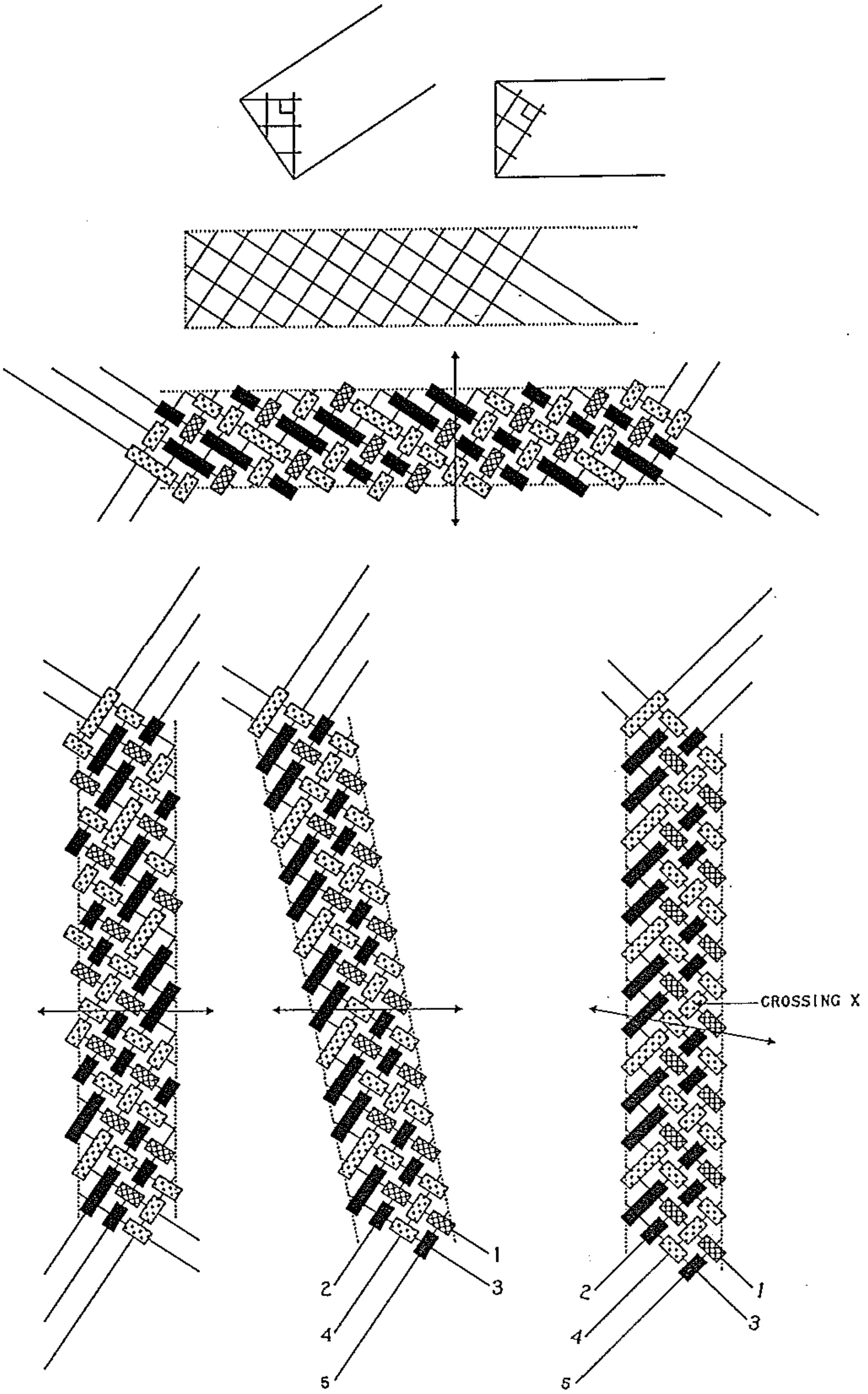

Fig. 979 — The 5-string Round Bihelix Braid with $[n_l, n_r] = [2, 3]$.

The braid of the stem begins immediately below the Double Constrictor Knot and consists of a sequence of Crown Knots, one on top the other as shown in Figs. 980 and 981. The indicated colour scheme for the strings gives the braid of the stem four columns of alternate coloured V's pointing away from the thimble.

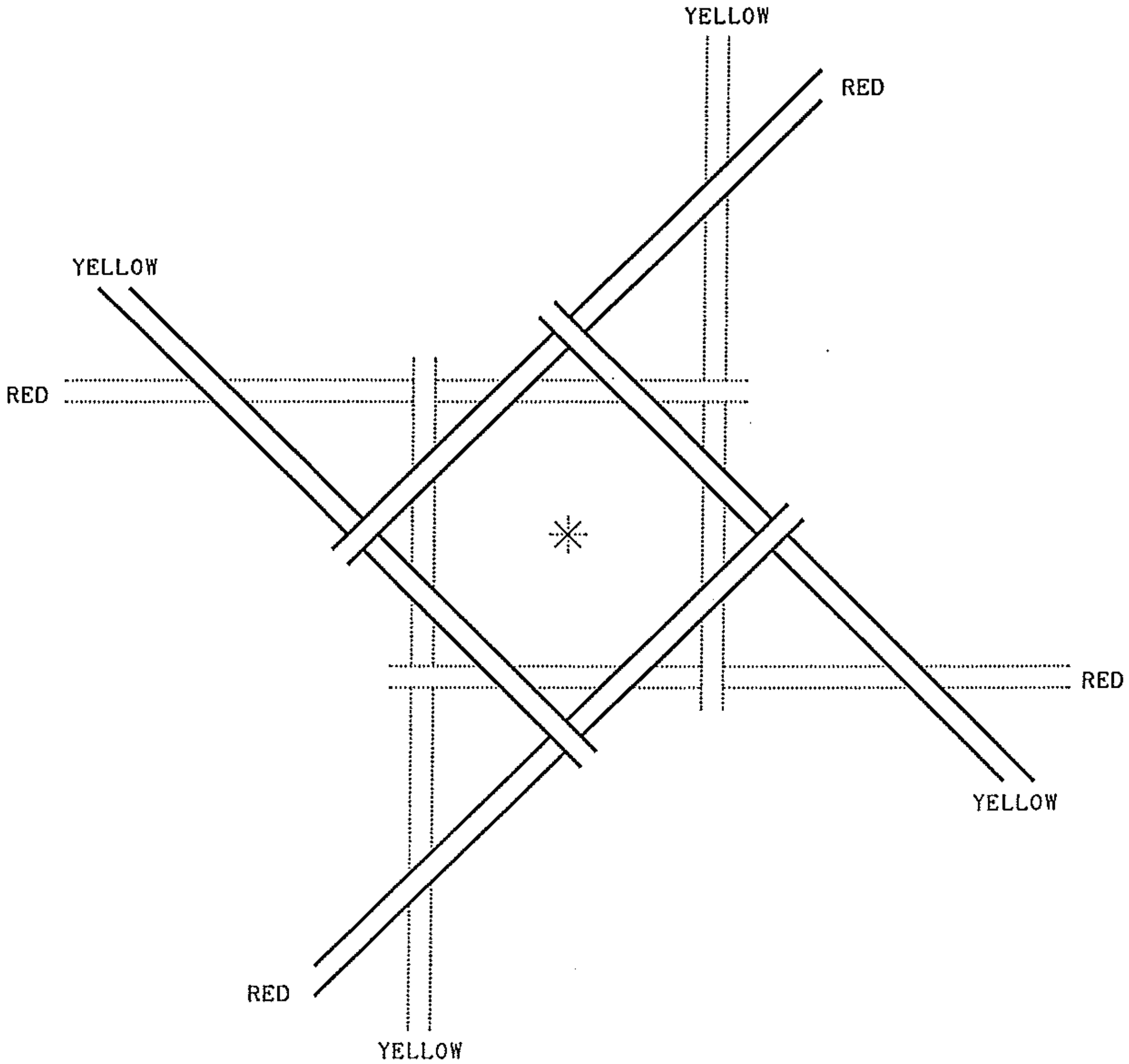

Fig. 980 — The position of two successive Crown Knots.

Fig. 981 shows the successive braiding of the odd and even numbered Crown Knots. When the final stem-length has been reached (final stem-length approximately 75 mm.) and the braid is nice and tight, tie off with a Double Constrictor Knot and melt the string-ends together.

The dimensions of the oval bead over the stem-braid are: meridional diameter is 19 mm., internal diameter after enlarging the hole is 11.5 mm. (that is 0.5 mm. less than the diameter of the stem-braid), length after enlarging the hole is 23 mm.. A small hole of 2 mm. diameter is drilled along the meridional diameter of the oval bead. The oval bead is then pushed over the stem-braid firmly against the thimble and fixed to the stem with a brass nail through this hole. Next the ends of the brass nail are made flush with the surface of the oval bead and the bead painted red since this is the main clour of the knot which will be placed over it.

$(11/22/11)\{1_1 2_3 3_2/3_1 2_2 1_3\}15$ is the string-run specification of the knot over the oval bead with its left bight-edge towards the thimble. It is an interbraid of three under-over coded Regular Knots, each with $p/b = 8/5$. Although their string-runs are identical, the knots are not identical; two have the identical under-over coding and one, the foundation knot, has their complementary under-over coding (see Fig. 982). We shall braid the odd-numbered half-cycles in each of these three components from upper-right to lower-left and the even-numbered half-cycles from upper-left to lower-right. We first braid the half-cycles 1-10 (the foundation knot; red cord 2 mm. diameter), next the half-cycles 1′-10′ (red cord 2 mm. diameter), and then the half-cycles 1″-10″ (yellow cord 2 mm. diameter. Finally we work the string-ends away.

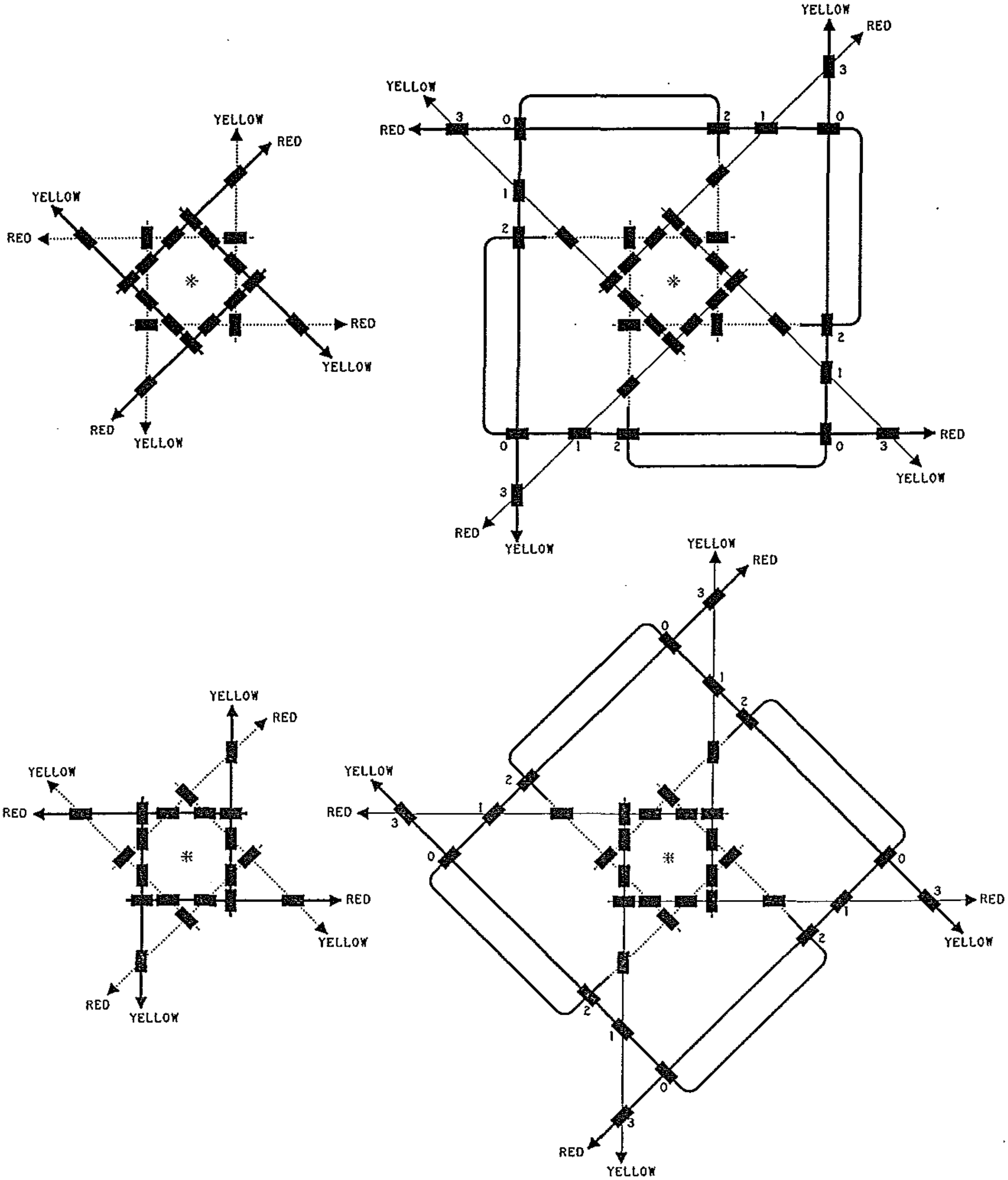

Fig. 981 — Successive braiding stages of the odd and even numbered Crown Knots.

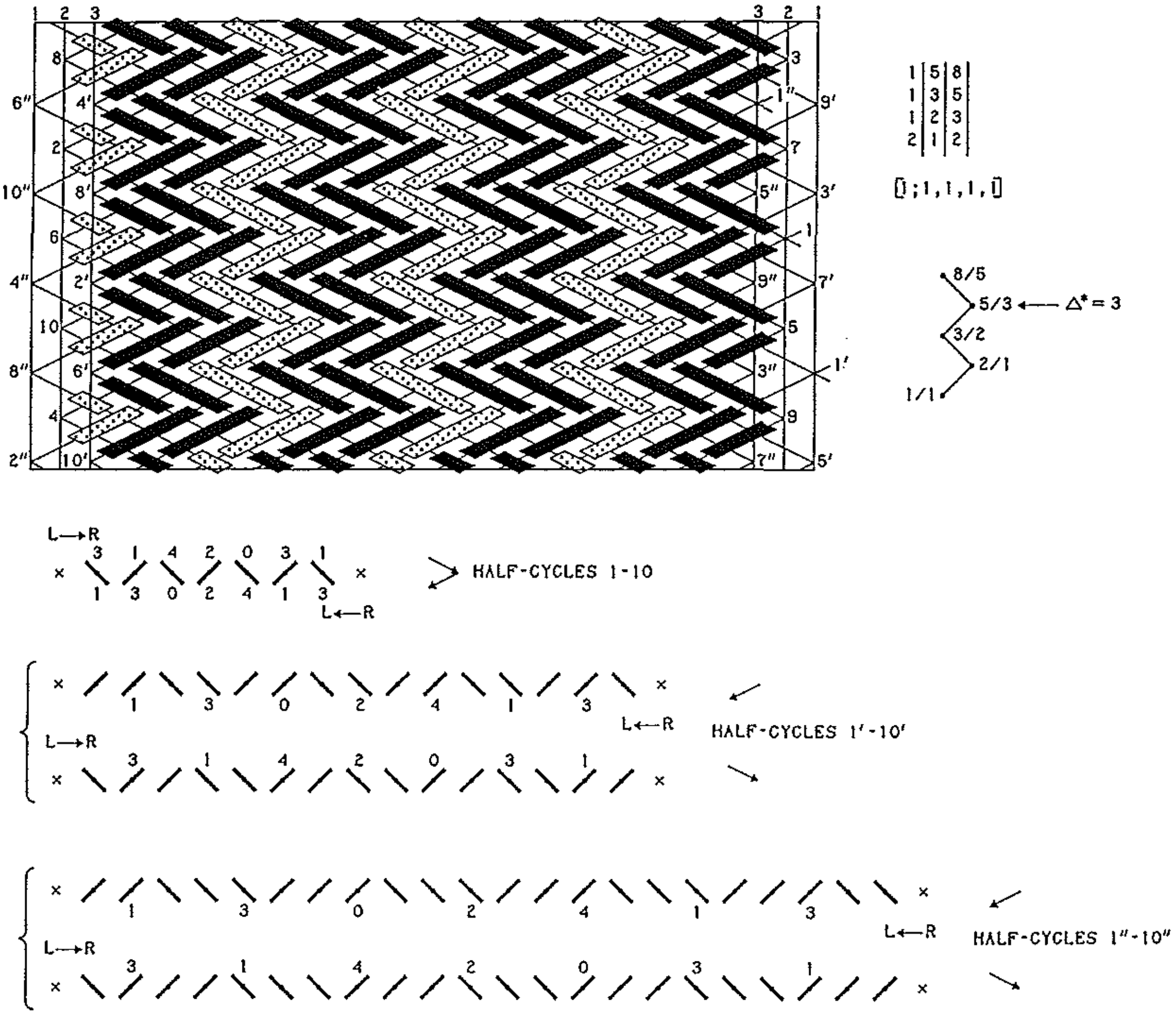

Fig. 982 — The knot over the oval bead.

From the algorithm diagrams in Fig. 982 of the respective components we read the following half-cycle braiding algorithms:

half-cycle 1 : $R_2 \longrightarrow L_2$: Free run.
half-cycle 2 : $i = 0$; $L_2 \longrightarrow R_2$: $(s)o$.
half-cycle 3 : $i = 0$; $R_2 \longrightarrow L_2$: u .
half-cycle 4 : $i \leq 1$; $L_2 \longrightarrow R_2$: $(s)u - (1,s)2o$.
half-cycle 5 : $i \leq 1$; $R_2 \longrightarrow L_2$: $o - 2u$.
half-cycle 6 : $i \leq 2$; $L_2 \longrightarrow R_2$: $(1,s)2u - 2o$.
half-cycle 7 : $i \leq 2$; $R_2 \longrightarrow L_2$: $2o - 2u$.
half-cycle 8 : $i \leq 3$; $L_2 \longrightarrow R_2$: $(s)o - 2u - o - (s)u - o$.
half-cycle 9 : $i \leq 3$; $R_2 \longrightarrow L_2$: $u - 2o - u - o - u$.
half-cycle 10 : $i \leq 4$; $L_2 \longrightarrow R_2$: $o - u - (s)o - u - o - u - o$.

half-cycle 1′ : $R_1 \longrightarrow L_3$: $u - o - u - o - u - o - u - o$.
half-cycle 2′ : $i = 0$; $L_3 \longrightarrow R_1$: $o - u - o - u - o - (s,1)2u - o - u$.
half-cycle 3′ : $i = 0$; $R_1 \longrightarrow L_3$: $u - o - u - o - u - 2o - u - o$.
half-cycle 4′ : $i \leq 1$; $L_3 \longrightarrow R_1$: $o - u - (s,1)2o - u - o - 2u - o - (s,1)2u$.
half-cycle 5′ : $i \leq 1$; $R_1 \longrightarrow L_3$: $u - o - 2u - o - u - 2o - u - 2o$.
half-cycle 6′ : $i \leq 2$; $L_3 \longrightarrow R_1$: $o - u - 2o - u - (s,1)2o - 2u - o - 2u$.

half-cycle 7′ : $i \le 2$; $R_1 \longrightarrow L_3$: $u - o - 2u - o - 2u - 2o - u - 2o$.
half-cycle 8′ : $i \le 3$; $L_3 \longrightarrow R_1$: $o - (s,1)2u - 2o - u - 2o - 2u - (s,1)2o - 2u$.
half-cycle 9′ : $i \le 3$; $R_1 \longrightarrow L_3$: $u - 2o - 2u - o - 2u - 2o - 2u - 2o$.
half-cycle 10′ : $i \le 4$; $L_3 \longrightarrow R_1$: $o - 2u - 2o - (s,1)2u - 2o - 2u - 2o - 2u$.

half-cycle 1″ : $R_3 \longrightarrow L_1$: $2u - 2o - 2u - 2o - 2u - 2o - 2u - o$.
half-cycle 2″ : $i = 0$; $L_1 \longrightarrow R_3$: $o - 2u - 2o - 2u - 2o - (s,2)3u - 2o - 2u$.
half-cycle 3″ : $i = 0$; $R_3 \longrightarrow L_1$: $2u - 2o - 2u - 2o - 2u - 3o - 2u - o$.
half-cycle 4″ : $i \le 1$; $L_1 \longrightarrow R_3$: $o - 2u - (s,2)3o - 2u - 2o - 3u - 2o - (s,2)3u$.
half-cycle 5″ : $i \le 1$; $R_3 \longrightarrow L_1$: $2u - 2o - 3u - 2o - 2u - 3o - 2u - 2o$.
half-cycle 6″ : $i \le 2$; $L_1 \longrightarrow R_3$: $o - 2u - 3o - 2u - (s,2)3o - 3u - 2o - 3u$.
half-cycle 7″ : $i \le 2$; $R_3 \longrightarrow L_1$: $2u - 2o - 3u - 2o - 3u - 3o - 2u - 2o$.
half-cycle 8″ : $i \le 3$; $L_1 \longrightarrow R_3$: $o - (s,2)3u - 3o - 2u - 3o - 3u - (s,2)3o - 3u$.
half-cycle 9″ : $i \le 3$; $R_3 \longrightarrow L_1$: $2u - 3o - 3u - 2o - 3u - 3o - 3u - 2o$.
half-cycle 10″ : $i \le 4$; $L_1 \longrightarrow R_3$: $o - 3u - 3o - (s,2)3u - 3o - 3u - 3o - 3u$.

The string-ends are worked away by twisting the string-ends tight under tension followed by cutting the exposed ends off. This will cause the string-ends to retract under the braid.

A round bead with a diameter of 24 mm. is placed at the end of the stem in a similar way as was done for the key-hangers No. 2, No. 3 and No. 4. With a few layers of tape we can accentuate the desired shape after which we give it the main colour of the knot over it (in this case blue). The knot over this round bead is as described in *The Braider*, Issue No. 51, pp. 1197-1206. The colour of the cord of the foundation knot is blue (cord diameter 2 mm.) and the colour of the cord of the interbraided knot is yellow (cord diameter 2 mm.).

THE BRAIDER'S NOTEBOOK

On pp. 278-179 in the *Encyclopedia of Rawhide and Leather Braiding* by Bruce Grant we find described the construction of a *Round Button of Four Thongs*. As described there, its grid-diagram is as depicted by uppermost right-hand grid-diagram in Fig. 983 (the lowermost right-hand grid-diagram in Fig. 983 depicts its complementary form). This Button Knot is the *Boton Redondo* before Fig. N° 77, pg. 74 in the book *Trenzas Gauchas* by Mario A. Lopez Osornio, and as such is a very unsatisfactory Button Knot since the string-ends are only very loosly held inside the knot. By further laying down the half-cycles 5 in the uppermost (and lowermost) right-hand grid-diagram in Fig. 984, while ensuring that the ends of the half-cycles 4 and the beginnings of the half-cycles 5 extend well past the left bight-edge, we arrive at the *Boton Redondo* (and its complementary form) before the final adjustment. Then, while leaving these extended half-cycle ends, remove all further slack in the Button Knot (the top of the initial Crown Knot depicted in the upper and lower left-most diagrams in Fig. 984 remains just exposed) and only after that has been done remove the extended half-cycle ends of the half-cycles 4 and 5 by pulling the ends of half-cycles 5 tight; thus causing the Wall Knot, formed by laying down the half-cycles 5, to slide under the braid below the initial Crown Knot. Finally the projecting string-ends of the half-cycles 5 above the initial Crown Knot are cut off.

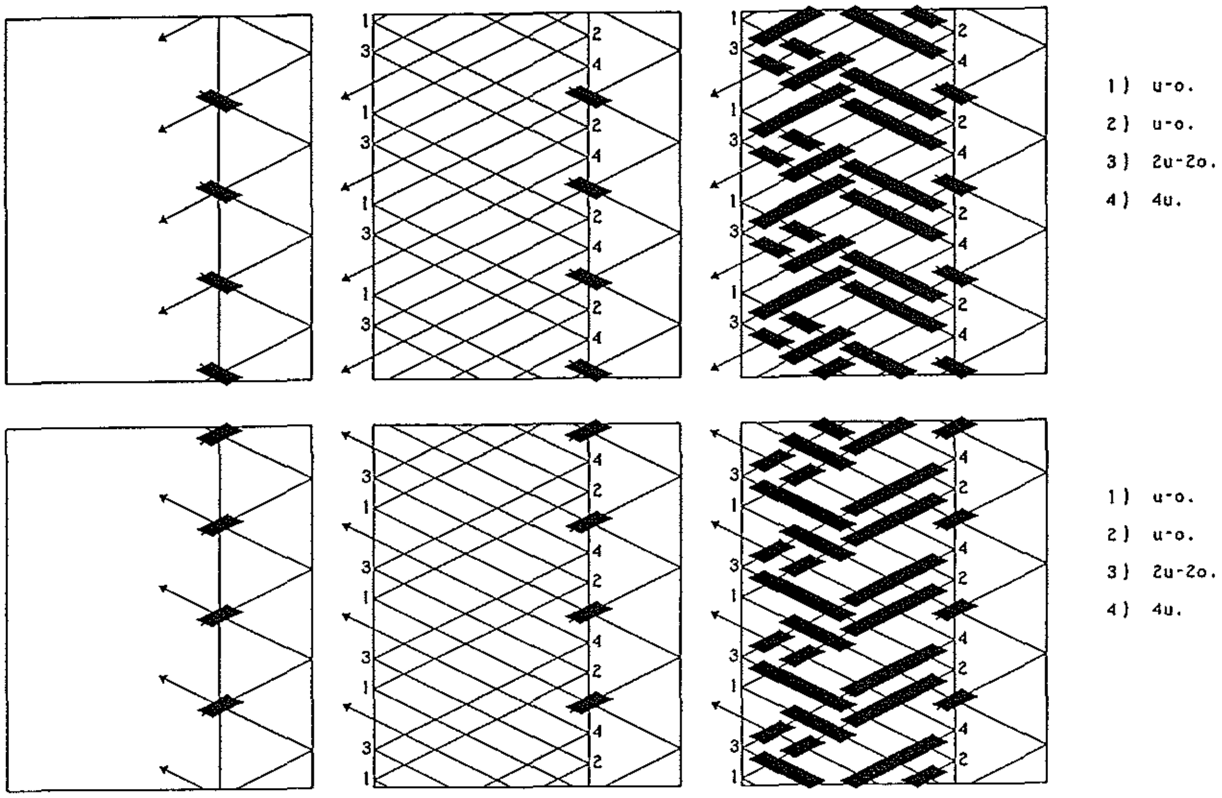

Fig. 983 — The Round Button of Four Thongs as described in the *Encyclopedia of Rawhide and Leather Braiding* by Bruce Grant.

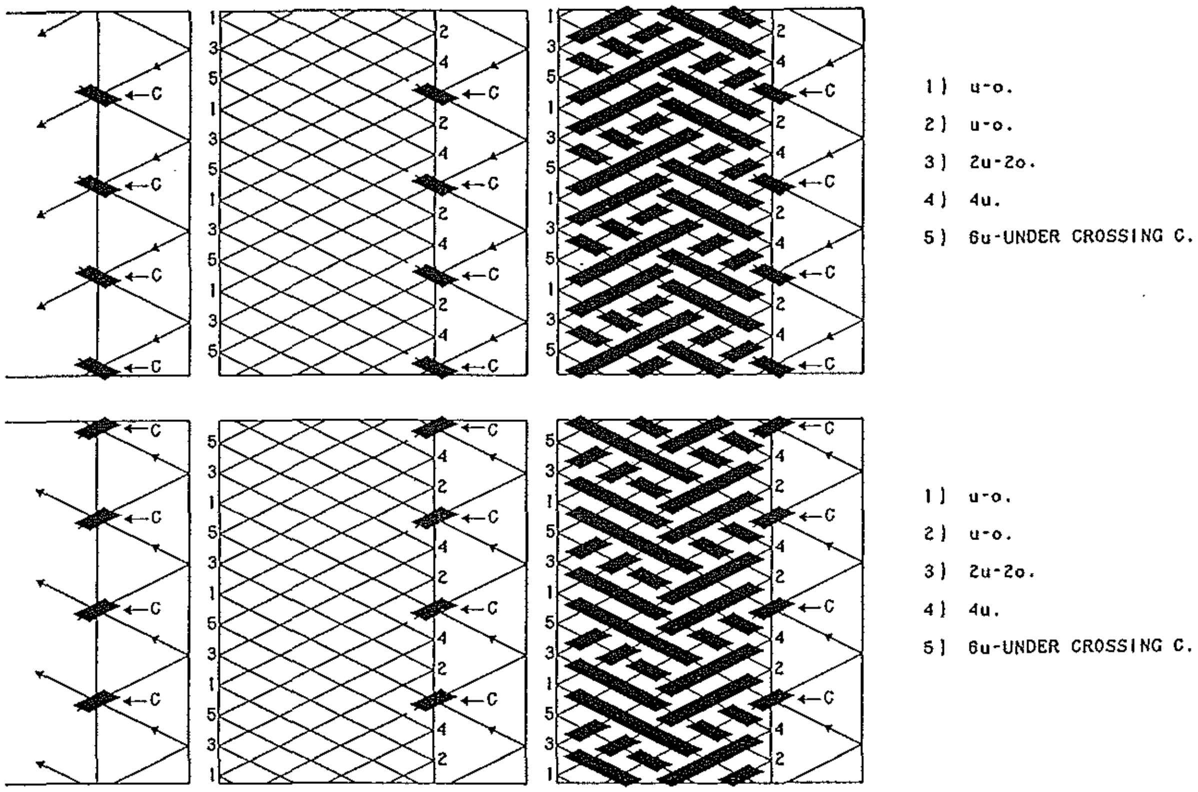

Fig. 984 — The Boton Redondo.

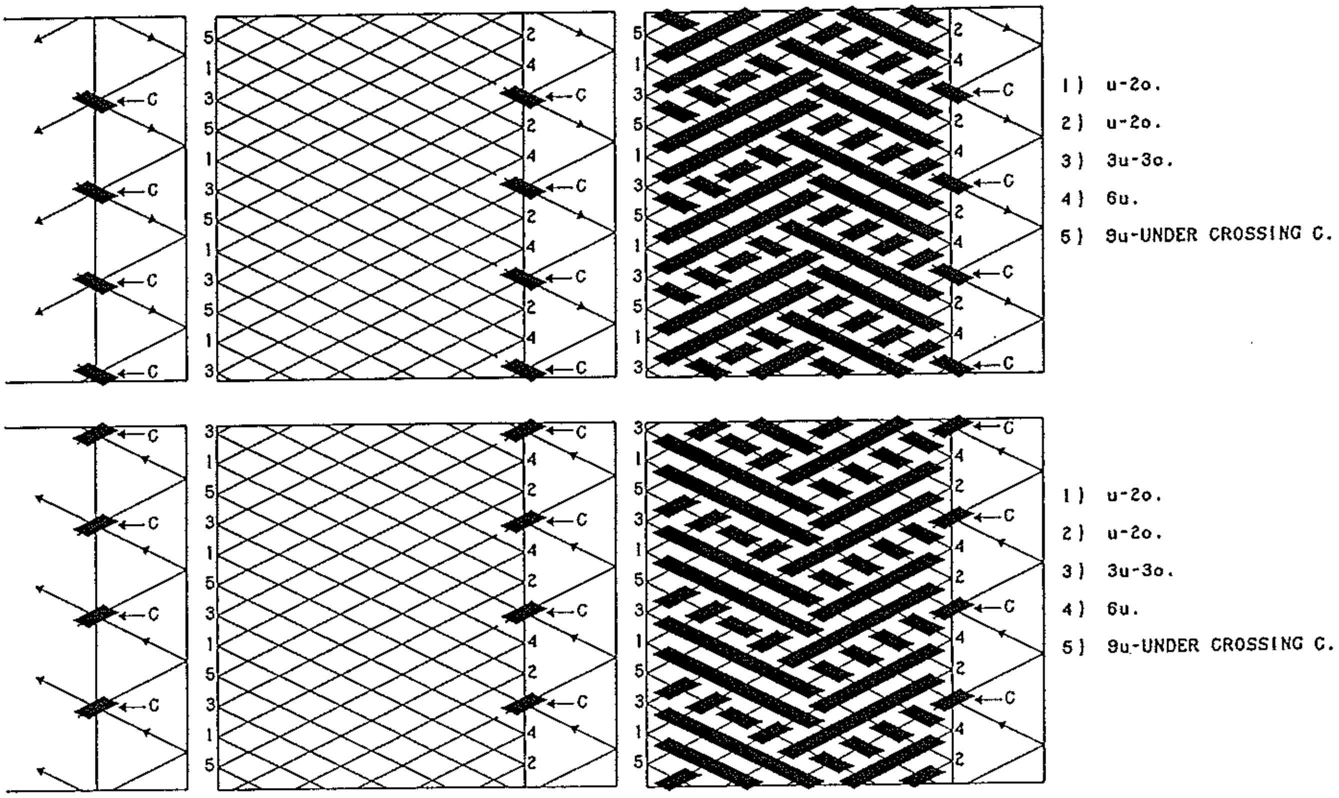

Fig. 985 — The Boton Redondo of Four Thongs with a 3-pass Spanish Ring Knot braid below the initial Crown Knot.

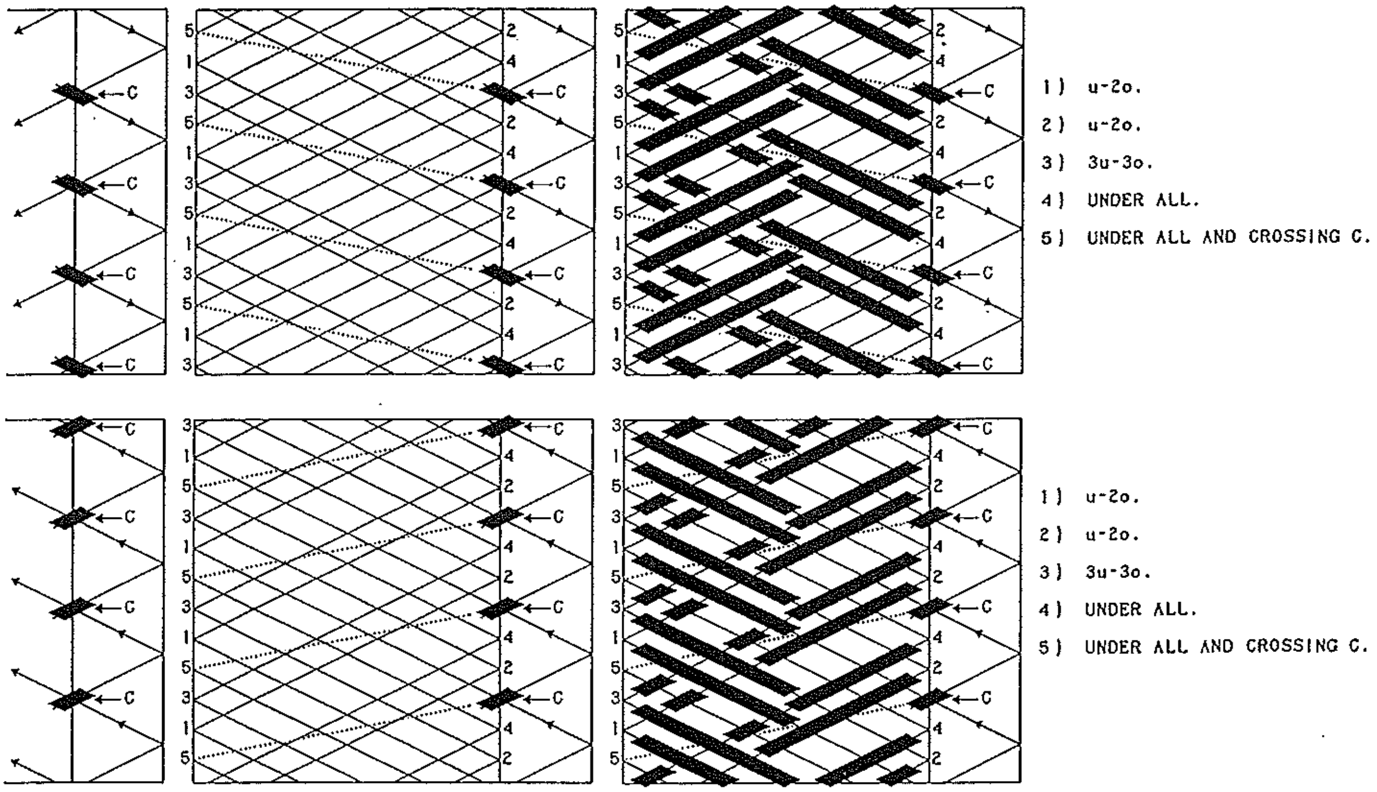

Fig. 986 — A modification of the path of half-cycles 5.

In contrast to the *Round Button of Four Thongs* in the *Encyclopedia of Rawhide and Leather Braiding* by Bruce Grant, the string-ends in the completed Boton Redondo are very tightly locked inside the knot. The braid below the initial Crown Knot is a 2-pass Spanish Ring Knot braid. A bigger and more substantial Button Knot is obtained by having a 3-pass Spanish Ring Knot braid below the initial Crown Knot. Braiding such a Button Knot as depicted in Fig.985 makes the removal of the extended half-cycle ends of the half-cycles 4 and 5, by pulling the ends of half-cycles 5 tight, a little more difficult but applying a little lubrication will aid this process. Alternatively we can modify the path of the half-cycles 5 as depicted in Fig. 986.

The Spanish Ring Knot braid under the Crown Knot has eight bights in the above discussed Button Knots. Such Button Knots can suitably be employed at the end of four string Round Braids. A similar Button Knot from six strings would have under the Crown Knot a Spanish Ring Knot with twelve bights, but would in general not be compatible with a six string Round Braid. For a six string Round Braid proper compatibility would in general be achieved when the Ring Knot has nine bights. Since a six string Round braid has three strings with a left helix and three with a right helix we can use one of these sets for a foundation knot over the six string Round Braid and under the Ring Knot braid. In Fig. 987 the six string Round Braid ends with the three left helix strings outermost and the three right helix strings innermost (left-hand diagram). With the three left helix strings we braid the foundation knot over the six string Round Braid, starting with crowning these strings to the left (turn six string Round Braid upside down, see right-hand diagram). The three right helix strings (which are innermost) we crown to the right. The string-ends of the left helix strings are fed through the eye of the left Crown Knot followed by feeding them through the eye of the right Crown Knot.

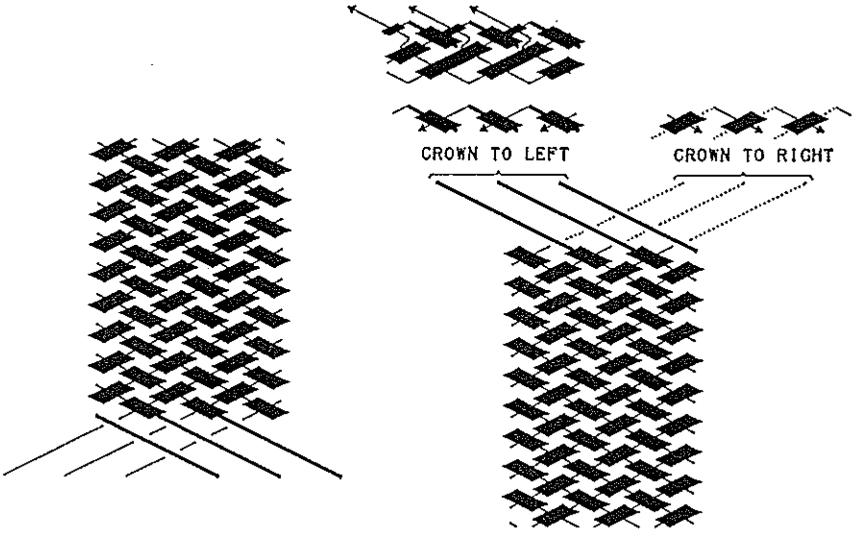

Fig. 987 — Six string Round Braid with foundation knot.

Over the foundation knot we braid the actual Button Knot with its upper end being the right Crown Knot (see the upper three diagrams in Fig. 988). Ensure that the ends of the half-cycles 6 and the beginnings of the half-cycles 7 extend well past the left bight-edge, before the final adjustment takes place. Then, while leaving these extended half-cycle ends, remove all further slack in the Button Knot (the top of the initial right Crown Knot depicted in the uppermost left-hand diagram in Fig. 988 remains just exposed) and only after that has been done remove the extended half-cycle ends of the half-cycles 6 and 7 by pulling the ends of half-cycles 7 tight; thus causing the Wall Knot, formed by laying down the half-cycles 7, to slide under the 'Ring Knot' braid below the initial right Crown Knot. Finally all the projecting string-ends above the initial right Crown Knot are cut off. Note that the 'Ring Knot' braid is not a true Spanish Ring Knot since it has a 4/5-pass.

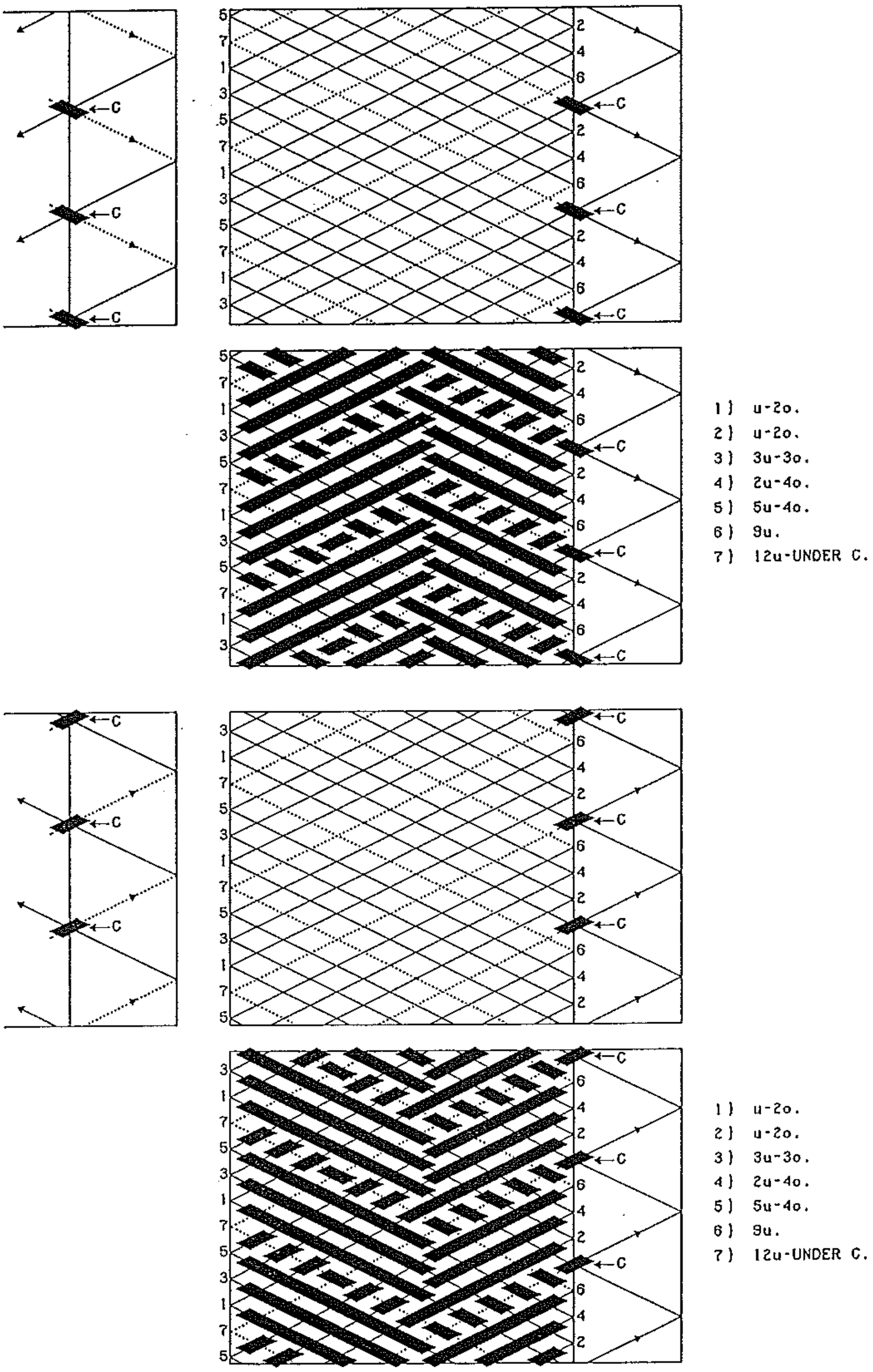

Fig. 988 — The Button Knot over the foundation knot.

The complementary form of this Button Knot is depicted by the lower three diagrams in Fig. 988, while its associated foundation knot over the six string Round Braid is depicted in Fig. 989.

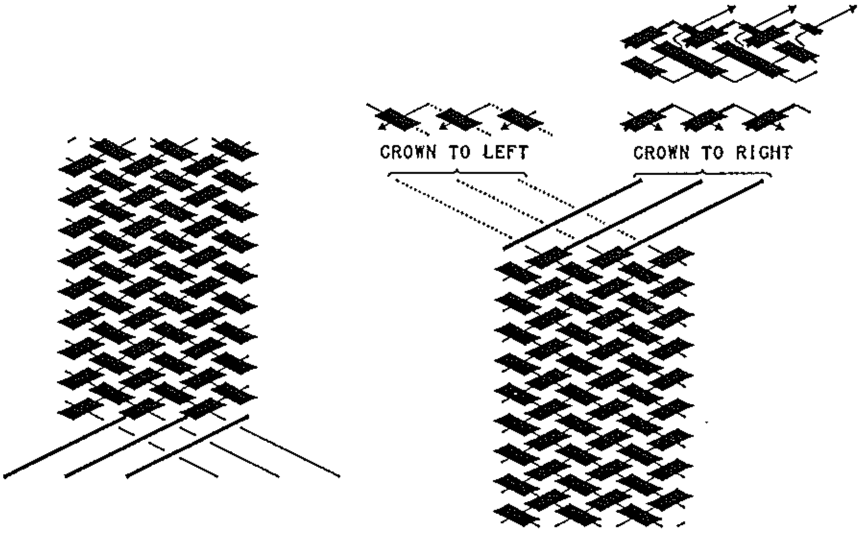

Fig. 989 — Six string Round Braid with foundation knot.

Interbraided Cylindrical Braids

Let in a Cylindrical Braid the values of the left-helix angle and the right-helix angle of the string-run be the same and let the angle α of the string-run be defined as (90° − *helix angle*).

The helix angle depends on the number of bights. Refer to *The Braider*, Issue No. 52, pg. 1227 $\longrightarrow b = \frac{C_s \cdot \sin\alpha}{w}$. In theory w is the width or diameter of the string but, depending on the compressibility of the string, in practice $b \cdot w$ is a little more than the theoretical value of $b \cdot w$. In theory C_s is $\pi \cdot (D + 2w)$, where D is the diameter of the cylinder over which the knot is placed but, depending on the compressibility of the string, in practice C_s is a little less than the theoretical value of $\pi \cdot (D + 2w)$. Hence in theory $\alpha = \arcsin\left(\frac{b \cdot w}{C_s}\right) = \arcsin\left(\frac{b \cdot w}{\pi \cdot (D+2w)}\right)$ but in practice α is a little more than $\arcsin\left(\frac{b \cdot w}{\pi \cdot (D+2w)}\right)$. The helix angle of a half-cycle is equal to $90^\circ - \alpha$ and hence in practice the helix angle of a half-cycle is a little less than $90^\circ - \arcsin\left(\frac{b \cdot w}{\pi \cdot (D+2w)}\right)$.

Fig. 990 depicts a small section of the string-run of a Regular Knot with b bights which is interbraided with $(n - 1)$ strings between adjacent bights. An intersection-column contains $n \cdot b$ intersection points. Let the braid be made of round string with diameter d over a diameter D at the column concerned. Then:

$$\pi(D + 2d) = \frac{n \cdot b \cdot d}{\sin\alpha}.$$

Hence when n increases to $(n + 1)$, while the helix angle (and hence the angle α) of the string-run remains the same, the diameter D at this column is increased by:

$$\frac{b \cdot d}{\pi \cdot \sin\alpha}.$$

When n increases to $(n+1)$, while the diameter D remains the same, the angle α of the string-run at this intersection-column is increased by:

$$\arcsin\frac{(n+1)\cdot b\cdot d}{\pi(D+2d)} - \arcsin\frac{n\cdot b\cdot d}{\pi(D+2d)}\dagger,$$

while the helix angle is decreased by the same amount.

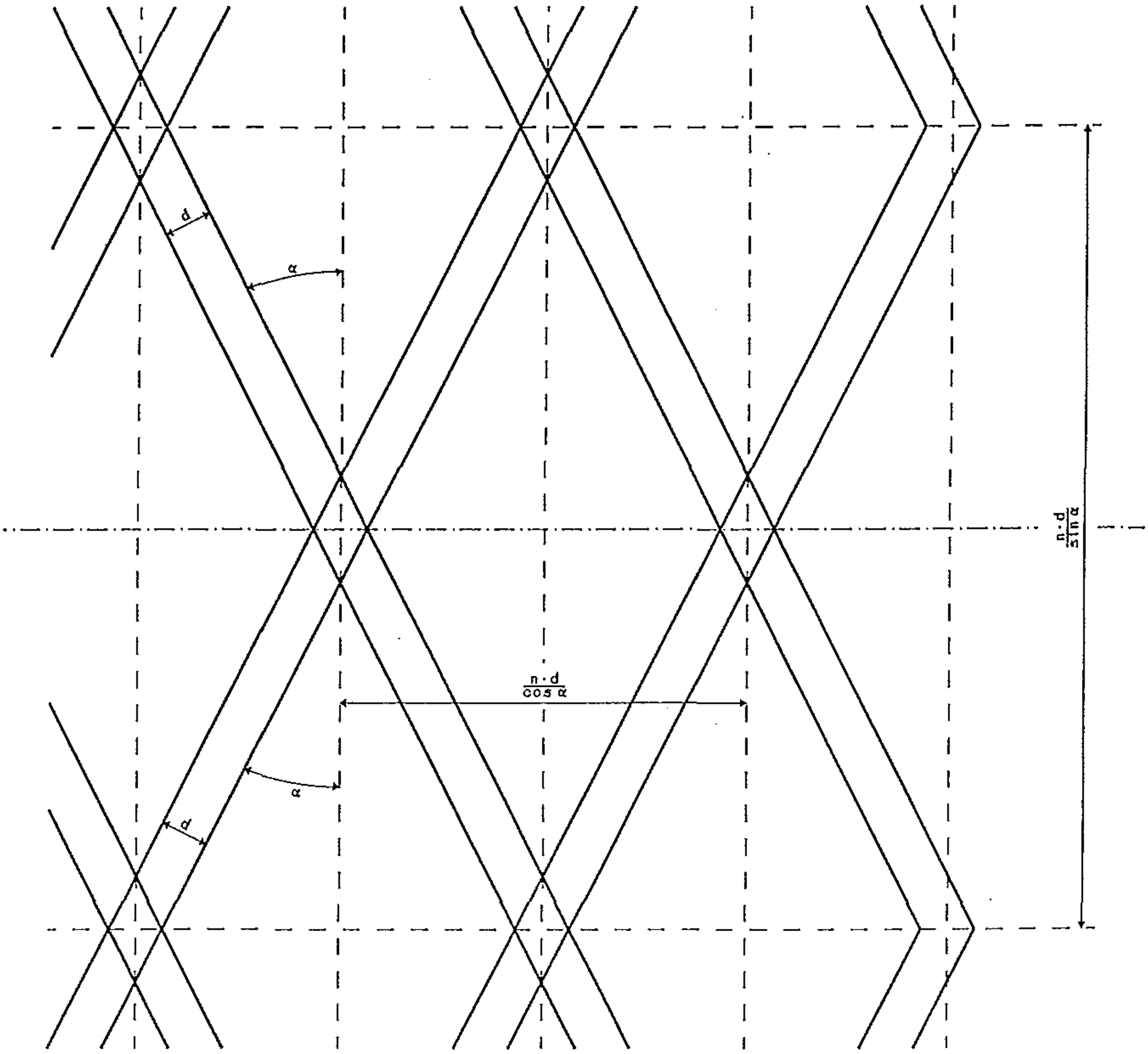

Fig. 990 — A Regular Knot with b bights interbraided with $(n-1)$ strings between adjacent bights.

Example 1.

The foundation knot is a Regular Knot with $p/b = 19/13$. It is interbraided with two Regular Knots, each with $p/b = 6/13$, as shown in Fig. 991. The string diameter of all strings is $d = 2.0$ mm. and the foundation knot is braided over a diameter $D = 24$ mm..

The interbraided knot contains five intersection-column sections, three sections in which each intersection-column contains 13 intersection points (intersection-columns 1,

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† arcsin x (also written as $\sin^{-1} x$) is the *arc* of which the *sine* is equal to x.

13-18, 30 from the left) and two sections in which each intersection-column contains 26 intersection points (intersection-columns 2-12, 19-29 from the left).

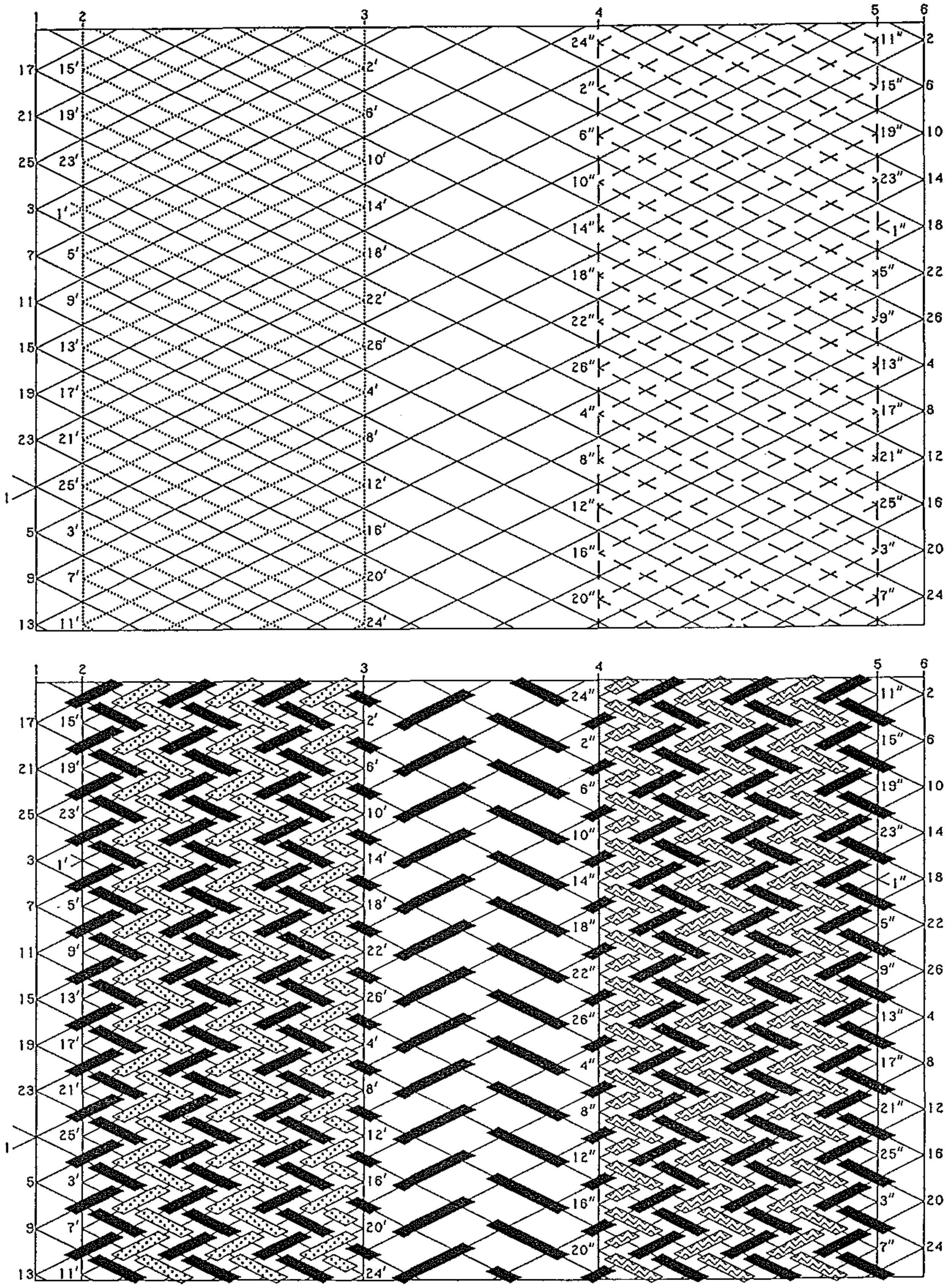

Fig. 991 — Example 1.

The helix angle of the string-run at the intersection-columns with 13 intersection points each is thus:

$$90^\circ - \arcsin \frac{13 \times 2.0}{\pi(24 + 2.0)} = 90^\circ - 18.56^\circ = 71.44^\circ\,.$$

When the diameter under the braid at the intersection-columns with 26 intersection points each is also 24 mm., then the helix angle of the string-run at these intersection-columns will be:

$$90^\circ - \arcsin \frac{26 \times 2.0}{\pi(24 + 2.0)} = 90^\circ - 39.54^\circ = 50.46^\circ\,.$$

The intersection columns 2-12 inclusive from the left have each 26 crossing points, hence with the helix angle of 71.44°, the diameter under this section of braid should be:

$$D = \frac{26 \times 2.0}{\pi \times \sin(90^\circ - 71.44^\circ)} - (2 \times 2.0) = 48.0\,\text{mm.},$$

Such a rapid diameter change from 24 mm. to 48 mm. is of course not acceptable.

Note that the bights on bight-boundary 3 and the bights on bight-boundary 4 lie on top of the braid (see Fig. 992) and hence are able to cover at these bight-boundaries the gaps (to the right of bight-boundary 3 and to the left of bight-boundary 4) between the strings of the foundation knot associated with the helix angle change from 50.46° to 71.44°.

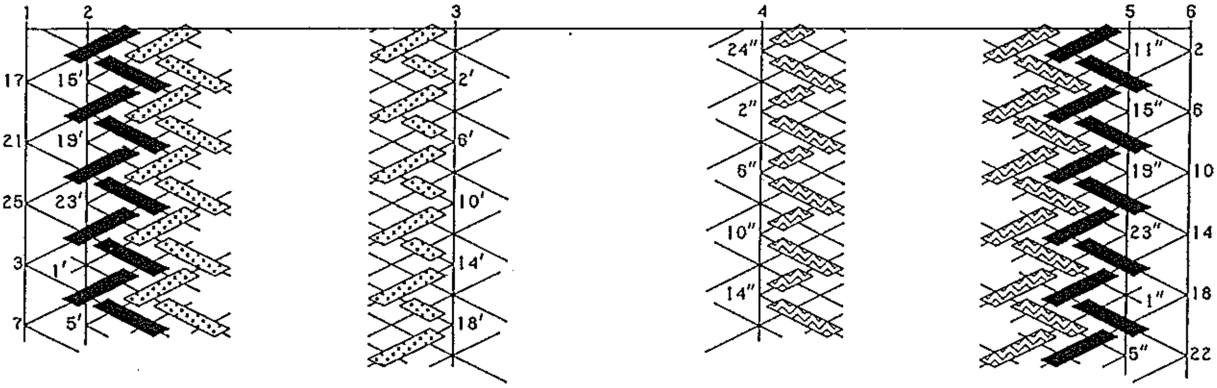

Fig. 992 — The string-runs near the bight-boundaries.

The bights on bight-boundary 2 and the bights on bight-boundary 5 lie under the braid, but since there are no further intersection columns to the left of bight-boundary 2, respectively to the right of bight-boundary 5, the gaps between the strings of the foundation knot, associated with the helix angle change from 50.46° to 71.44°, are covered by the bights on the respective bight-boundaries 1 and 6 (see Fig. 992).

The foundation knot (between bight-boundaries 1 and 6) is a Regular Knot with 19 parts and 13 bights. Euclid's algorithm, its path in the RKT and its algorithm diagram are presented in the upper part of Fig. 993. From its algorithm diagram we read the following half-cycle braiding algorithms:

1. : Free run.
2. $(i = 0)$: $(s)o$.
3. $(i = 0)$: o.
4. $(i \leq 1)$: $(s)u - o$.
5. $(i \leq 1)$: $u - o$.
6. $(i \leq 2)$: $(s)o - u - o - (s)u$.
7. $(i \leq 2)$: $o - u - o - u$.

8. $(i \leq 3)$: $o - u - (s,1)2o - u$.
9. $(i \leq 3)$: $o - u - 2o - u$.
10. $(i \leq 4)$: $o - (s,1)2u - 2o - u - (s)o$.
11. $(i \leq 4)$: $o - 2u - 2o - u - o$.
12. $(i \leq 5)$: $o - 2u - (1,s,1)3o - u - o$.
13. $(i \leq 5)$: $o - 2u - 3o - u - o$.
14. $(i \leq 6)$: $o - u - (s)o - u - 3o - u - o - (s)u$.
15. $(i \leq 6)$: $o - u - o - u - 3o - u - o - u$.
16. $(i \leq 7)$: $o - u - o - u - 2o - (s)u - o - u - o - u$.
17. $(i \leq 7)$: $o - u - o - u - 2o - u - o - u - o - u$.
18. $(i \leq 8)$: $o - u - o - (s,1)2u - 2o - u - o - u - o - u - (s)o$.
19. $(i \leq 8)$: $o - u - o - 2u - 2o - u - o - u - o - u - o$.
20. $(i \leq 9)$: $o - u - o - 2u - 2o - (1,s)2u - o - u - o - u - o$.
21. $(i \leq 9)$: $o - u - o - 2u - 2o - 2u - o - u - o - u - o$.
22. $(i \leq 10)$: $o - u - o - u - (s)o - u - 2o - 2u - o - u - o - u - o - (s)u$.
23. $(i \leq 10)$: $o - u - o - u - o - u - 2o - 2u - o - u - o - u - o - u$.
24. $(i \leq 11)$: $o - u - o - u - o - u - 2o - 2u - (s,1)2o - u - o - u - o - u$.
25. $(i \leq 11)$: $o - u - o - u - o - u - 2o - 2u - 2o - u - o - u - o - u$.
26. $(i \leq 12)$: $o - u - o - u - o - (s,1)2u - 2o - 2u - 2o - u - o - u - o - u$.

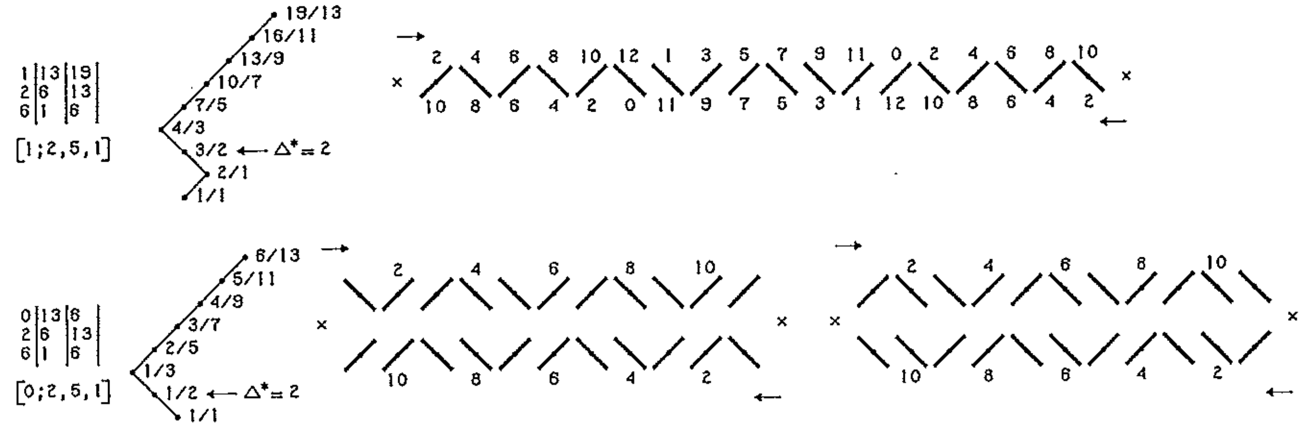

Fig. 993 — Algorithm diagrams associated with Fig. 991.

The left interbraid (between bight-boundary 2 and bight-boundary 3) and the right interbraid (between bight-boundary 4 and bight-boundary 5) are Regular Knots, each with 6 parts and 13 bights. Euclid's algorithm, their path in the RKT and their algorithm diagrams are presented in the lower part of Fig. 993 (left algorithm diagram for left interbraid and right algorithm diagram for right interbraid). From the left algorithm diagram we read for the left interbraid the following half-cycle braiding algorithms:

1′. : $u - o - u - o - u - o$.
2′. $(i = 0)$: $o - u - o - u - o - u$.
3′. $(i = 0)$: $u - o - u - o - u - o$.
4′. $(i \leq 1)$: $o - u - o - u - o - u$.
5′. $(i \leq 1)$: $u - o - u - o - u - o$.
6′. $(i \leq 2)$: $o - (s,1)2u - o - u - o - u$.

$7'$. $(i \leq 2)$: $u - 2o - u - o - u - o$.
$8'$. $(i \leq 3)$: $o - 2u - o - u - o - u$.
$9'$. $(i \leq 3)$: $u - 2o - u - o - u - o$.
$10'$. $(i \leq 4)$: $o - 2u - (s,1)2o - u - o - u$.
$11'$. $(i \leq 4)$: $u - 2o - 2u - o - u - o$.
$12'$. $(i \leq 5)$: $o - 2u - 2o - u - o - u$.
$13'$. $(i \leq 5)$: $u - 2o - 2u - o - u - o$.
$14'$. $(i \leq 6)$: $o - 2u - 2o - (s,1)2u - o - u$.
$15'$. $(i \leq 6)$: $u - 2o - 2u - 2o - u - o$.
$16'$. $(i \leq 7)$: $o - 2u - 2o - 2u - o - u$.
$17'$. $(i \leq 7)$: $u - 2o - 2u - 2o - u - o$.
$18'$. $(i \leq 8)$: $o - 2u - 2o - 2u - (s,1)2o - u$.
$19'$. $(i \leq 8)$: $u - 2o - 2u - 2o - 2u - o$.
$20'$. $(i \leq 9)$: $o - 2u - 2o - 2u - 2o - u$.
$21'$. $(i \leq 9)$: $u - 2o - 2u - 2o - 2u - o$.
$22'$. $(i \leq 10)$: $o - 2u - 2o - 2u - 2o - (s,1)2u$.
$23'$. $(i \leq 10)$: $u - 2o - 2u - 2o - 2u - 2o$.
$24'$. $(i \leq 11)$: $o - 2u - 2o - 2u - 2o - 2u$.
$25'$. $(i \leq 11)$: $u - 2o - 2u - 2o - 2u - 2o$.
$26'$. $(i \leq 12)$: $o - 2u - 2o - 2u - 2o - 2u$.

From the lower right algorithm diagram in Fig. 993 we read the half-cycle braiding algorithms for the right interbraid:

$1''$. : $u - o - u - o - u - o$.
$2''$. $(i = 0)$: $o - u - o - u - o - u$.
$3''$. $(i = 0)$: $u - o - u - o - u - o$.
$4''$. $(i \leq 1)$: $o - u - o - u - o - u$.
$5''$. $(i \leq 1)$: $u - o - u - o - u - o$.
$6''$. $(i \leq 2)$: $o - (s,1)2u - o - u - o - u$.
$7''$. $(i \leq 2)$: $u - 2o - u - o - u - o$.
$8''$. $(i \leq 3)$: $o - 2u - o - u - o - u$.
$9''$. $(i \leq 3)$: $u - 2o - u - o - u - o$.
$10''$. $(i \leq 4)$: $o - 2u - (s,1)2o - u - o - u$.
$11''$. $(i \leq 4)$: $u - 2o - 2u - o - u - o$.
$12''$. $(i \leq 5)$: $o - 2u - 2o - u - o - u$.
$13''$. $(i \leq 5)$: $u - 2o - 2u - o - u - o$.
$14''$. $(i \leq 6)$: $o - 2u - 2o - (s,1)2u - o - u$.
$15''$. $(i \leq 6)$: $u - 2o - 2u - 2o - u - o$.
$16''$. $(i \leq 7)$: $o - 2u - 2o - 2u - o - u$.
$17''$. $(i \leq 7)$: $u - 2o - 2u - 2o - u - o$.
$18''$. $(i \leq 8)$: $o - 2u - 2o - 2u - (s,1)2o - u$.
$19''$. $(i \leq 8)$: $u - 2o - 2u - 2o - 2u - o$.
$20''$. $(i \leq 9)$: $o - 2u - 2o - 2u - 2o - u$.
$21''$. $(i \leq 9)$: $u - 2o - 2u - 2o - 2u - o$.
$22''$. $(i \leq 10)$: $o - 2u - 2o - 2u - 2o - (s,1)2u$.
$23''$. $(i \leq 10)$: $u - 2o - 2u - 2o - 2u - 2o$.
$24''$. $(i \leq 11)$: $o - 2u - 2o - 2u - 2o - 2u$.
$25''$. $(i \leq 11)$: $u - 2o - 2u - 2o - 2u - 2o$.
$26''$. $(i \leq 12)$: $o - 2u - 2o - 2u - 2o - 2u$.

Note that the half-cycle braiding algorithms for the right interbraid are identical to the half-cycle braiding algorithms for the left interbraid.

Example 2.

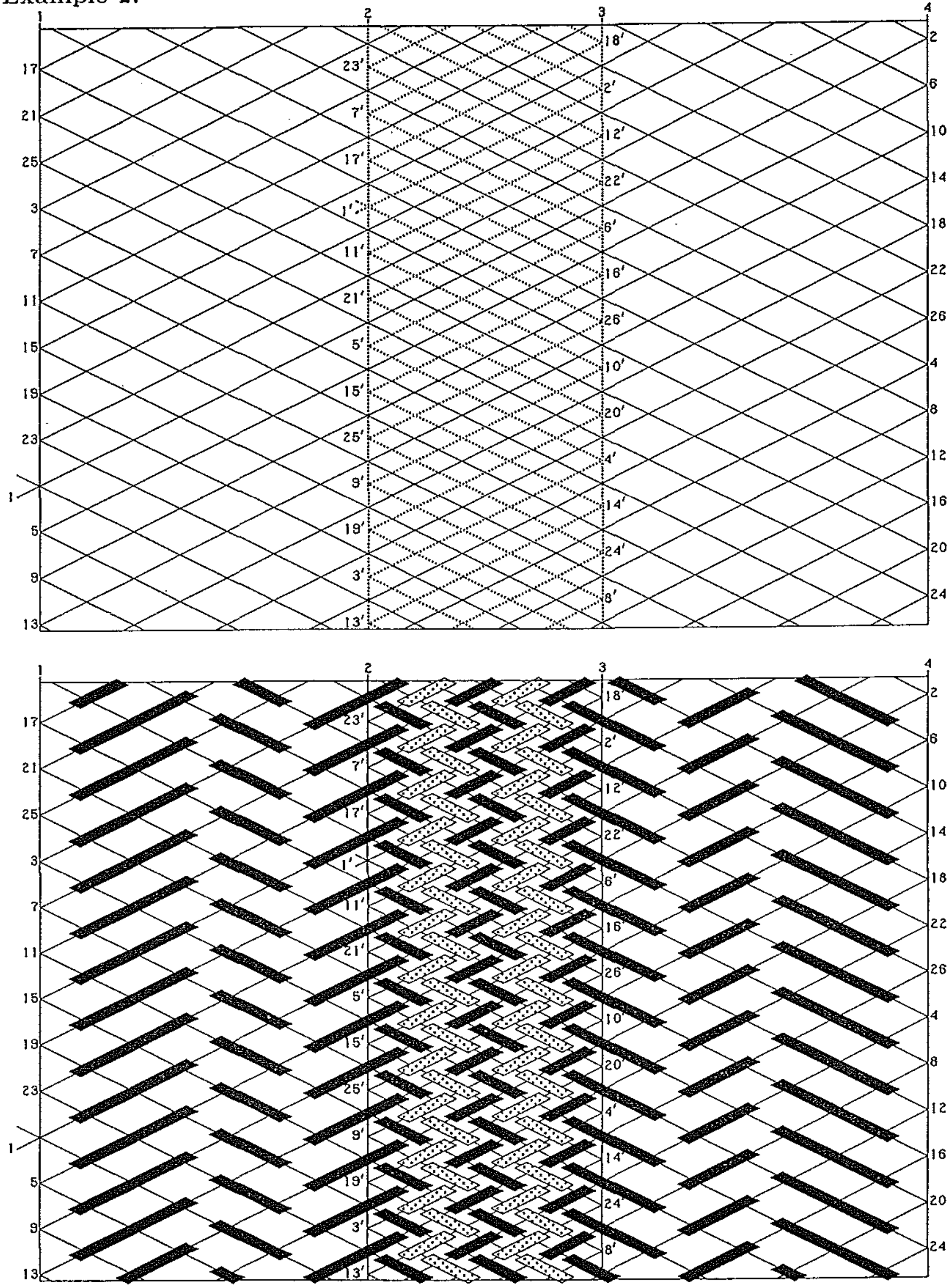

Fig. 994 — Example 2.

The foundation knot is a Regular Knot with $p/b = 19/13$. It is interbraided with one Regular Knot with $p/b = 5/13$, as shown in Fig. 994. The string diameter of all strings is $d = 2.0$ mm. and the foundation knot is braided over a diameter $D = 24$ mm..

The interbraided knot contains three intersection-column sections, two sections in which each intersection-column contains 13 intersection points (intersection-columns 1-7 and 17-23), and one section in which each intersection-column contains 26 intersection points (intersection-columns 8-16).

The helix angle of the string-run at the intersection-columns with 13 intersection points each is thus:

$$90^\circ - \arcsin \frac{13 \times 2.0}{\pi(24 + 2.0)} = 90^\circ - 18.56^\circ = 71.44^\circ .$$

When the diameter under the braid at the intersection-columns with 26 intersection points each is also 24 mm., then the helix angle of the string-run at these intersection-columns will be:

$$90^\circ - \arcsin \frac{26 \times 2.0}{\pi(24 + 2.0)} = 90^\circ - 39.54^\circ = 50.46^\circ .$$

The bights on bight-boundary 2 and the bights on bight-boundary 3 lie under the braid. The resulting gaps between the strings of the foundation knot, associated with the helix angle change from 50.46° to 71.44°, cannot here be covered by bights and hence in good braidwork this situation must be avoided.

The foundation knot (between bight-boundaries 1 and 4) is a Regular Knot with 19 parts and 13 bights. Euclid's algorithm, its path in the RKT and its algorithm diagram are presented in the upper part of Fig. 995.

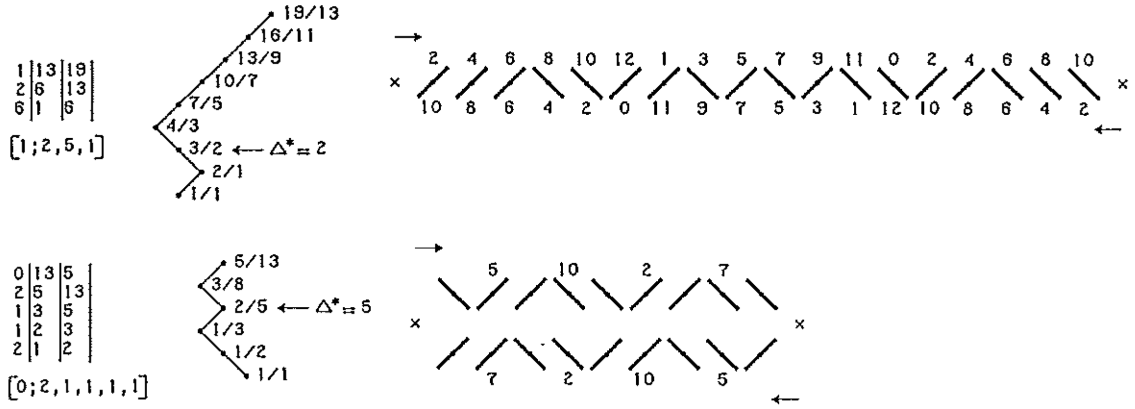

Fig. 995 — Algorithm diagrams associated with Fig. 994.

The half-cycle braiding algorithms for the foundation knot, read from its algorithm diagram, are as follows:

1. : Free run.
2. $(i = 0)$: $(s)u$.
3. $(i = 0)$: u.
4. $(i \leq 1)$: $(s)o - u$.
5. $(i \leq 1)$: $o - u$.
6. $(i \leq 2)$: $(s, 1)2o - u - (s)o$.
7. $(i \leq 2)$: $2o - u - o$.
8. $(i \leq 3)$: $2o - (s, 1)2u - o$.
9. $(i \leq 3)$: $2o - 2u - o$.
10. $(i \leq 4)$: $(1, s, 1)3o - 2u - (1, s)2o$.

11. $(i \leq 4)$: $3o - 2u - 2o.$
12. $(i \leq 5)$: $3o - u - (s)o - u - 2o.$
13. $(i \leq 5)$: $3o - u - o - u - 2o.$
14. $(i \leq 6)$: $(2,s,1)4o - u - o - u - 2o - (s)u.$
15. $(i \leq 6)$: $4o - u - o - u - 2o - u.$
16. $(i \leq 7)$: $4o - u - o - (s,1)2u - 2o - u.$
17. $(i \leq 7)$: $4o - u - o - 2u - 2o - u.$
18. $(i \leq 8)$: $3o - (s)u - o - u - o - 2u - 2o - (1,s)2u.$
19. $(i \leq 8)$: $3o - u - o - u - o - 2u - 2o - 2u.$
20. $(i \leq 9)$: $3o - u - o - u - o - u - (s)o - u - 2o - 2u.$
21. $(i \leq 9)$: $3o - u - o - u - o - u - o - u - 2o - 2u.$
22. $(i \leq 10)$: $3o - (1,s)2u - o - u - o - u - o - u - 2o - (2,s)3u.$
23. $(i \leq 10)$: $3o - 2u - o - u - o - u - o - u - 2o - 3u.$
24. $(i \leq 11)$: $3o - 2u - o - u - o - u - o - (s,1)2u - 2o - 3u.$
25. $(i \leq 11)$: $3o - 2u - o - u - o - u - o - 2u - 2o - 3u.$
26. $(i \leq 12)$: $3o - 2u - (s,1)2o - u - o - u - o - 2u - 2o - 3u.$

The interbraid (between bight-boundary 2 and bight-boundary 3) is a Regular Knot with 5 parts and 13 bights. Euclid's algorithm, its path in the RKT and its algorithm diagram is presented in the lower part of Fig. 995. From this algorithm diagram we read the following half-cycle braiding algorithms for the interbraid:

$1'$. : $u - o - u - o - u.$
$2'$. $(i = 0)$: $u - o - u - o - u.$
$3'$. $(i = 0)$: $u - o - u - o - u.$
$4'$. $(i \leq 1)$: $u - o - u - o - u.$
$5'$. $(i \leq 1)$: $u - o - u - o - u.$
$6'$. $(i \leq 2)$: $u - o - u - (s,1)2o - u.$
$7'$. $(i \leq 2)$: $u - o - u - 2o - u.$
$8'$. $(i \leq 3)$: $u - o - u - 2o - u.$
$9'$. $(i \leq 3)$: $u - o - u - 2o - u.$
$10'$. $(i \leq 4)$: $u - o - u - 2o - u.$
$11'$. $(i \leq 4)$: $u - o - u - 2o - u.$
$12'$. $(i \leq 5)$: $u - (s,1)2o - u - 2o - u.$
$13'$. $(i \leq 5)$: $u - 2o - u - 2o - u.$
$14'$. $(i \leq 6)$: $u - 2o - u - 2o - u.$
$15'$. $(i \leq 6)$: $u - 2o - u - 2o - u.$
$16'$. $(i \leq 7)$: $u - 2o - u - 2o - (s,1)2u.$
$17'$. $(i \leq 7)$: $u - 2o - u - 2o - 2u.$
$18'$. $(i \leq 8)$: $u - 2o - u - 2o - 2u.$
$19'$. $(i \leq 8)$: $u - 2o - u - 2o - 2u.$
$20'$. $(i \leq 9)$: $u - 2o - u - 2o - 2u.$
$21'$. $(i \leq 9)$: $u - 2o - u - 2o - 2u.$
$22'$. $(i \leq 10)$: $u - 2o - (s,1)2u - 2o - 2u.$
$23'$. $(i \leq 10)$: $u - 2o - 2u - 2o - 2u.$
$24'$. $(i \leq 11)$: $u - 2o - 2u - 2o - 2u.$
$25'$. $(i \leq 11)$: $u - 2o - 2u - 2o - 2u.$
$26'$. $(i \leq 12)$: $u - 2o - 2u - 2o - 2u.$

In *The Braider*, Issue No. 29, pg. 682, we derived the general law of the greatest common divisor:

$$\lambda = \text{g.c.d.}\left(\frac{\beta}{\alpha}, \frac{B_c}{\alpha}\right),$$

where α is the number of bights in the component's first-return string-run, β is the number of bights the first-return string-run spans in the component, and B_c is the component's number of bights.[†]

Note that the general law of the greatest common divisor dictates that both β and B_c must be divisible by α.

Let the first-return string-run of a component in a cylindrical braid be as shown in Fig. 996.

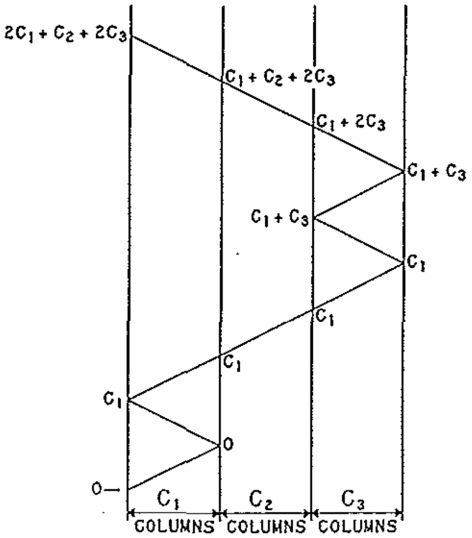

Fig. 996 — The first-return string-run of a component in a cylindrical braid.

In this diagram the bight-index numbers of the intersection points between the first-return string-run and the bight-boundaries are indicated. Thus for this component $\beta = 2C_1 + C_2 + 2C_3$ while $\alpha = 3$. Let's take $C_1 = C_3$, then $\beta = 4C_1 + C_2 = 4C_3 + C_2$.

Example 3.

Let $C_1 = C_3 = 14$ and $C_2 = 10$, then $\beta = 4 \times 14 + 10 = 66$. Note that C_1, C_2 and C_3 must be chosen so that β is divisible by $\alpha = 3$.

Let $B_c = 27$. Note that B_c must be chosen so that B_c is divisible by $\alpha = 3$.

Thus for this component we obtain:

$$\lambda = \text{g.c.d.}\left(\frac{\beta}{\alpha}, \frac{B_c}{\alpha}\right) = \text{g.c.d.}\left(\frac{66}{3}, \frac{27}{3}\right) = \text{g.c.d.}\ (22, 9) = 1,$$

and hence only one essential string is required.

The string-run of this component consist of $\left(\frac{B_c}{\alpha}\right) = \left(\frac{27}{3}\right) = 9$ consecutive first-return string-runs.

The successively occupied bight-index numbers by the string-run of this component are:

On the leftmost bight-boundary:

[†] See *The Braider*, Issue No. 30, pp. 683-690 for Examples.

0.
$|14|_{27} = 14$.
$|66|_{27} = 12$.
$|14 + 66|_{27} = 26$.
$|12 + 66|_{27} = 24$.
$|26 + 66|_{27} = 11$.

$|23 + 66|_{27} = 8$.
$|21 + 66|_{27} = 6$.
$|8 + 66|_{27} = 20$.
$|6 + 66|_{27} = 18$.
$|20 + 66|_{27} = 5$.
$|18 + 66|_{27} = 3$.

$|24 + 66|_{27} = 9$.
$|5 + 66|_{27} = 17$.
$|11 + 66|_{27} = 23$.
$|3 + 66|_{27} = 15$.
$|9 + 66|_{27} = 21$.
$|17 + 66|_{27} = 2$.

On the second bight-boundary from the left:

0.
$\nearrow\ |14|_{27} = 14$.
$\nwarrow\ |52|_{27} = 25$.
$|66|_{27} = 12$.
$\nearrow\ |14 + 66|_{27} = 26$.
$\nwarrow\ |25 + 66|_{27} = 10$.
$|12 + 66|_{27} = 24$.
$\nearrow\ |26 + 66|_{27} = 11$.
$\nwarrow\ |10 + 66|_{27} = 22$.

$|23 + 66|_{27} = 8$.
$\nearrow\ |21 + 66|_{27} = 6$.
$\nwarrow\ |22 + 66|_{27} = 7$.
$|8 + 66|_{27} = 20$.
$\nearrow\ |6 + 66|_{27} = 18$.
$\nwarrow\ |7 + 66|_{27} = 19$.
$|20 + 66|_{27} = 5$.
$\nearrow\ |18 + 66|_{27} = 3$.
$\nwarrow\ |19 + 66|_{27} = 4$.

$|24 + 66|_{27} = 9$.
$\nearrow\ |5 + 66|_{27} = 17$.
$\nwarrow\ |4 + 66|_{27} = 16$.
$|11 + 66|_{27} = 23$.
$\nearrow\ |3 + 66|_{27} = 15$.
$\nwarrow\ |16 + 66|_{27} = 1$.
$|9 + 66|_{27} = 21$.
$\nearrow\ |17 + 66|_{27} = 2$.
$\nwarrow\ |1 + 66|_{27} = 13$.

On the third bight-boundary from the left:

$\nearrow\ |14|_{27} = 14$.
$|28|_{27} = 1$.
$\nwarrow\ |42|_{27} = 15$.
$\nearrow\ |14 + 66|_{27} = 26$.
$|1 + 66|_{27} = 13$.
$\nwarrow\ |15 + 66|_{27} = 0$.
$\nearrow\ |26 + 66|_{27} = 11$.
$|13 + 66|_{27} = 25$.
$\nwarrow\ |0 + 66|_{27} = 12$.

$\nearrow\ |11 + 66|_{27} = 23$.
$|25 + 66|_{27} = 10$.
$\nwarrow\ |12 + 66|_{27} = 24$.
$\nearrow\ |23 + 66|_{27} = 8$.
$|10 + 66|_{27} = 22$.
$\nwarrow\ |24 + 66|_{27} = 9$.
$\nearrow\ |8 + 66|_{27} = 20$.
$|22 + 66|_{27} = 7$.
$\nwarrow\ |9 + 66|_{27} = 21$.

$\nearrow\ |20 + 66|_{27} = 5$.
$|7 + 66|_{27} = 19$.
$\nwarrow\ |21 + 66|_{27} = 6$.
$\nearrow\ |5 + 66|_{27} = 17$.
$|19 + 66|_{27} = 4$.
$\nwarrow\ |6 + 66|_{27} = 18$.
$\nearrow\ |17 + 66|_{27} = 2$.
$|4 + 66|_{27} = 16$.
$\nwarrow\ |18 + 66|_{27} = 3$.

On the rightmost bight-boundary:

$|14|_{27} = 14$.
$|28|_{27} = 1$.
$|14 + 66|_{27} = 26$.
$|1 + 66|_{27} = 13$.
$|26 + 66|_{27} = 11$.
$|13 + 66|_{27} = 25$.

$|11 + 66|_{27} = 23$.
$|25 + 66|_{27} = 10$.
$|23 + 66|_{27} = 8$.
$|10 + 66|_{27} = 22$.
$|8 + 66|_{27} = 20$.
$|22 + 66|_{27} = 7$.

$|20 + 66|_{27} = 5$.
$|7 + 66|_{27} = 19$.
$|5 + 66|_{27} = 17$.
$|19 + 66|_{27} = 4$.
$|17 + 66|_{27} = 2$.
$|4 + 66|_{27} = 16$.

In the tables above, the arrows in front of the bight-index numbers indicate the direction of the half-cycle at the bight-index number concerned. Note that on the leftmost bight-boundary the bight-index numbers $1, 4, 7, 10, 13, 16, 19, 22, 25$ are still free, and that on the rightmost bight-boundary the bight-index numbers $0, 3, 6, 9, 12, 15, 18, 21, 24$ are still free. The tables further indicate that we can interbraid this braid (the foundation braid) with two Regular Cylindrical Braids, one between the leftmost bight-boundary and the third bight-boundary from left, and one between the rightmost bight-boundary and the second bight-boundary from the left. For each of these braids $\alpha = 1$, $\beta = 8$ and $B_c = 9$. Hence:

$$\lambda = \text{g.c.d.}\left(\frac{\beta}{\alpha}, \frac{B_c}{\alpha}\right) = \text{g.c.d.}\left(\frac{8}{1}, \frac{9}{1}\right) = \text{g.c.d.}\ (8, 9) = 1,$$

and hence each braid is a Regular Knot, hence requires only one essential string.

In Fig. 997 the upper diagram depicts the string-run of the foundation braid and the lower diagram depicts the string-run of the two interbraided Regular Knots.

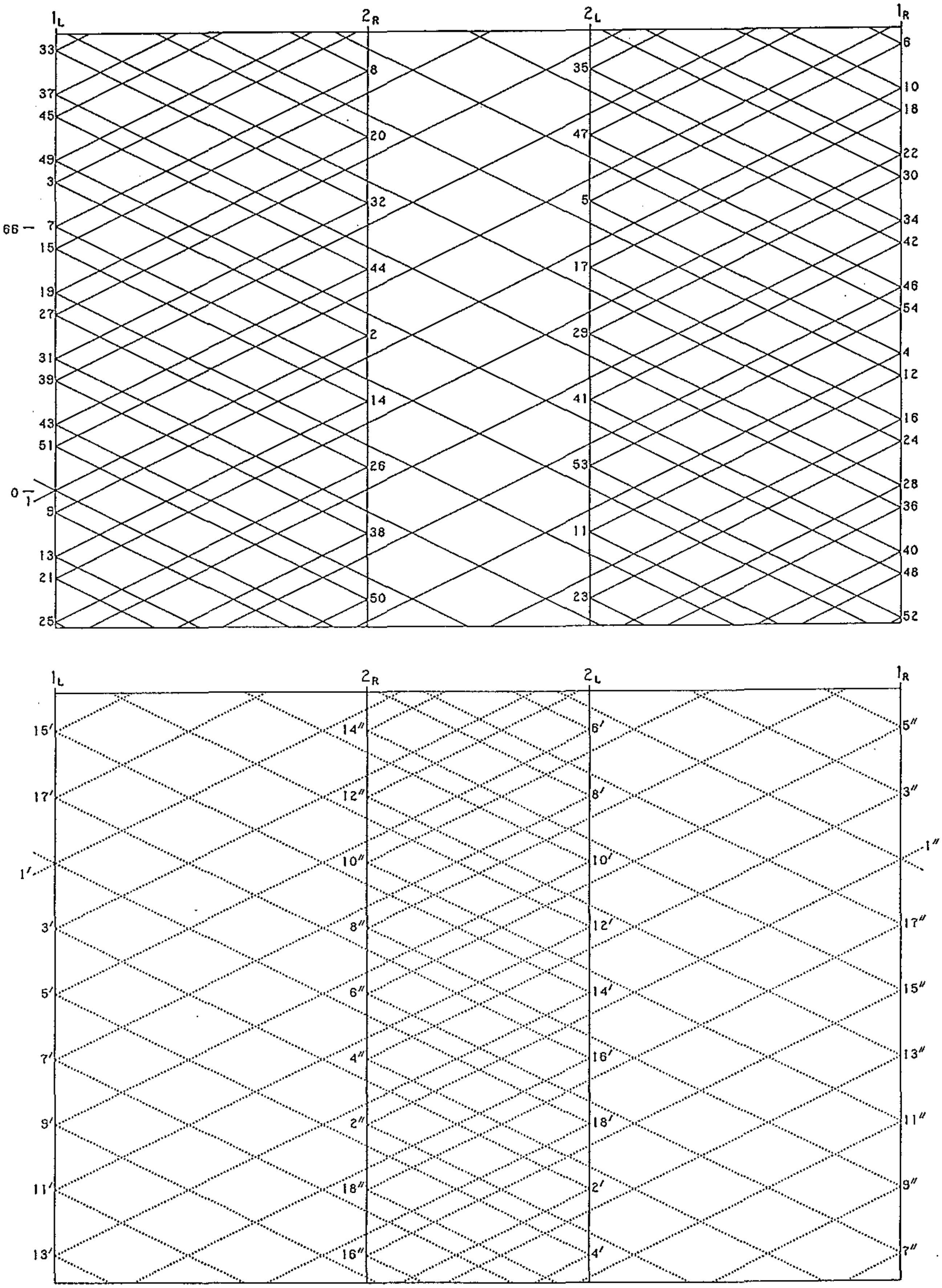

Fig. 997 — The string-runs of the foundation braid and the two interbraided Regular Knots.

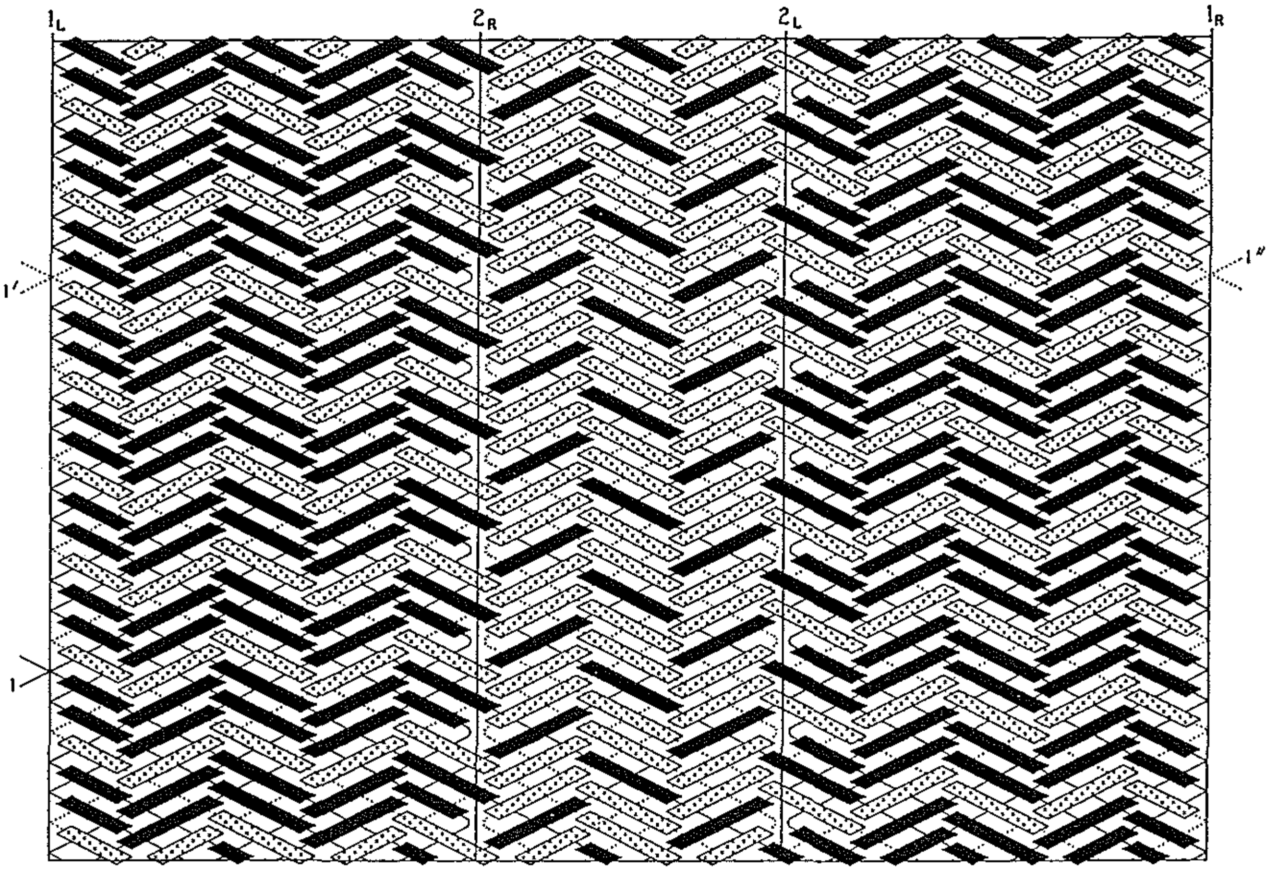

Fig. 998 — A coding superimposed on the string-run.

The braiding algorithms for the foundation knot can be read from the tables in Figs. 999 & 1000. In these tables, half-cycle n intersects the half-cycles which end at the beginning of the half-cycles $\leq n$ listed on their right. These tables give us the following half-cycle braiding algorithms:

1. $1_L \longrightarrow 2_R$: Free run.
2. $2_R \longrightarrow 1_L$: Free run.
3. $1_L \longrightarrow 1_R$: Free run.
4. $1_R \longrightarrow 2_L$: Free run.
5. $2_L \longrightarrow 1_R$: Free run.
6. $1_R \longrightarrow 1_L$: $2o$.
7. $1_L \longrightarrow 2_R$: u.
8. $2_R \longrightarrow 1_L$: o.
9. $1_L \longrightarrow 1_R$: $2u$.
10. $1_R \longrightarrow 2_L$: o.
11. $2_L \longrightarrow 1_R$: u.
12. $1_R \longrightarrow 1_L$: $3o - u$.
13. $1_L \longrightarrow 2_R$: u.
14. $2_R \longrightarrow 1_L$: $o - u$.
15. $1_L \longrightarrow 1_R$: $u - o - 2u - o$.
16. $1_R \longrightarrow 2_L$: $o - u$.
17. $2_L \longrightarrow 1_R$: $u - o$.
18. $1_R \longrightarrow 1_L$: $o - u - o - u - o - 2u$.

HALF-CYCLE								
1	51	43	39	31	27	19	15	7
7	3	49	45	37	33	25	21	13
13	9	☒	51	43	39	31	27	19
19	15	7	3	49	45	37	33	25
25	21	13	9	☒	51	43	39	31
31	27	19	15	7	3	49	45	37
37	33	25	21	13	9	☒	51	43
43	39	31	27	19	15	7	3	49
49	45	37	33	25	21	13	9	☒
	U	O	O	U	U	O	O	U

HALF-CYCLE								
5	☒	47	43	35	31	23	19	11
11	7	53	49	41	37	29	25	17
17	13	5	☒	47	43	35	31	23
23	19	11	7	53	49	41	37	29
29	25	17	13	5	☒	47	43	35
35	31	23	19	11	7	53	49	41
41	37	29	25	17	13	5	☒	47
47	43	35	31	23	19	11	7	53
53	49	41	37	29	25	17	13	5
	U	O	O	U	U	O	O	U

HALF-CYCLE																					
3	49	45	37	33	25	21	13	9	☒	43	31	19	7	53	49	41	37	29	25	17	13
9	☒	51	43	39	31	27	19	15	7	49	37	25	13	5	☒	47	43	35	31	23	19
15	7	3	49	45	37	33	25	21	13	☒	43	31	19	11	7	53	49	41	37	29	25
21	13	9	☒	51	43	39	31	27	19	7	49	37	25	17	13	5	☒	47	43	35	31
27	19	15	7	3	49	45	37	33	25	13	☒	43	31	23	19	11	7	53	49	41	37
33	25	21	13	9	☒	51	43	39	31	19	7	49	37	29	25	17	13	5	☒	47	43
39	31	27	19	15	7	3	49	45	37	25	13	☒	43	35	31	23	19	11	7	53	49
45	37	33	25	21	13	9	☒	51	43	31	19	7	49	41	37	29	25	17	13	5	☒
51	43	39	31	27	19	15	7	3	49	37	25	13	☒	47	43	35	31	23	19	11	7
	U	O	O	U	U	O	O	U	U	O	U	O	U	U	O	O	U	U	O	O	U

Fig. 999 — Tables for the odd-numbered half-cycles.

19. $1_L \longrightarrow 2_R: \quad u - 2o.$
20. $2_R \longrightarrow 1_L: \quad o - 2u.$
21. $1_L \longrightarrow 1_R: \quad u - o - u - o - u - 2o.$
22. $1_R \longrightarrow 2_L: \quad o - 2u.$
23. $2_L \longrightarrow 1_R: \quad u - 2o.$
24. $1_R \longrightarrow 1_L: \quad o - 2u - o - u - o - 2u - o.$
25. $1_L \longrightarrow 2_R: \quad u - 2o.$
26. $2_R \longrightarrow 1_L: \quad o - 2u - o.$
27. $1_L \longrightarrow 1_R: \quad u - 2o - 2u - o - u - 2o - u.$
28. $1_R \longrightarrow 2_L: \quad o - 2u - o.$
29. $2_L \longrightarrow 1_R: \quad u - 2o - u.$
30. $1_R \longrightarrow 1_L: \quad o - 2u - 2o - u - 2o - 2u - 2o.$
31. $1_L \longrightarrow 2_R: \quad u - 2o - 2u.$
32. $2_R \longrightarrow 1_L: \quad o - 2u - 2o.$
33. $1_L \longrightarrow 1_R: \quad u - 2o - 2u - o - 2u - 2o - 2u.$
34. $1_R \longrightarrow 2_L: \quad o - 2u - 2o.$
35. $2_L \longrightarrow 1_R: \quad u - 2o - 2u.$
36. $1_R \longrightarrow 1_L: \quad o - 2u - 3o - u - 2o - 2u - 2o - u.$
37. $1_L \longrightarrow 2_R: \quad u - 2o - 2u.$
38. $2_R \longrightarrow 1_L: \quad o - 2u - 2o - u.$
39. $1_L \longrightarrow 1_R: \quad u - 2o - 2u - o - u - o - 2u - 2o - 2u - o.$
40. $1_R \longrightarrow 2_L: \quad o - 2u - 2o - u.$

HALF-CYCLE								
2	52	44	40	32	28	20	16	8
8	4	50	46	38	34	26	22	14
14	10	2	52	44	40	32	28	20
20	16	8	4	50	46	38	34	26
26	22	14	10	2	52	44	40	32
32	28	20	16	8	4	50	46	38
38	34	26	22	14	10	2	52	44
44	40	32	28	20	16	8	4	50
50	46	38	34	26	22	14	10	2
	O	U	U	O	O	U	U	O

HALF-CYCLE								
4	54	46	42	34	30	22	18	10
10	6	52	48	40	36	28	24	16
16	12	4	54	46	42	34	30	22
22	18	10	6	52	48	40	36	28
28	24	16	12	4	54	46	42	34
34	30	22	18	10	6	52	48	40
40	36	28	24	16	12	4	54	46
46	42	34	30	22	18	10	6	52
52	48	40	36	28	24	16	12	4
	O	U	U	O	O	U	U	O

HALF-CYCLE																					
6	52	48	40	36	28	24	16	12	4	46	34	22	10	2	52	44	40	32	28	20	16
12	4	54	46	42	34	30	22	18	10	52	40	28	16	8	4	50	46	38	34	26	22
18	10	6	52	48	40	36	28	24	16	4	46	34	22	14	10	2	52	44	40	32	28
24	16	12	4	54	46	42	34	30	22	10	52	40	28	20	16	8	4	50	46	38	34
30	22	18	10	6	52	48	40	36	28	16	4	46	34	26	22	14	10	2	52	44	40
36	28	24	16	12	4	54	46	42	34	22	10	52	40	32	28	20	16	8	4	50	46
42	34	30	22	18	10	6	52	48	40	28	16	4	46	38	34	26	22	14	10	2	52
48	40	36	28	24	16	12	4	54	46	34	22	10	52	44	40	32	28	20	16	8	4
54	46	42	34	30	22	18	10	6	52	40	28	16	4	50	46	38	34	26	22	14	10
	O	U	U	O	O	U	U	O	O	U	O	U	O	O	U	U	O	O	U	U	O

Fig. 1000 — Tables for the even-numbered half-cycles.

41. $2_L \longrightarrow 1_R$: $u - 2o - 2u - o$.
42. $1_R \longrightarrow 1_L$: $o - 2u - 2o - u - o - u - o - u - o - 2u - 2o - 2u$.
43. $1_L \longrightarrow 2_R$: $u - 2o - 2u - 2o$.
44. $2_R \longrightarrow 1_L$: $o - 2u - 2o - 2u$.
45. $1_L \longrightarrow 1_R$: $u - 2o - 2u - o - u - o - u - o - u - 2o - 2u - 2o$.
46. $1_R \longrightarrow 2_L$: $o - 2u - 2o - 2u$.
47. $2_L \longrightarrow 1_R$: $u - 2o - 2u - 2o$.
48. $1_R \longrightarrow 1_L$: $o - 2u - 2o - 2u - o - u - o - u - o - 2u - 2o - 2u - o$.
49. $1_L \longrightarrow 2_R$: $u - 2o - 2u - 2o$.
50. $2_R \longrightarrow 1_L$: $o - 2u - 2o - 2u - o$.
51. $1_L \longrightarrow 1_R$: $u - 2o - 2u - 2o - 2u - o - u - o - u - 2o - 2u - 2o - u$.
52. $1_R \longrightarrow 2_L$: $o - 2u - 2o - 2u - o$.
53. $2_L \longrightarrow 1_R$: $u - 2o - 2u - 2o - u$.
54. $1_R \longrightarrow 1_L$: $o - 2u - 2o - 2u - 2o - u - o - u - 2o - 2u - 2o - 2u - o$.

Euclid's algorithm, the path formula, the path in the RKT for the interbraided Regular Knots and their algorithm diagrams are shown in Fig. 1001. For the interbraided Regular Knot between the bight-boundaries 1_L and 2_L we read the following half-cycle braiding algorithms from its algorithm diagram:

$1'$. : $2u - 2o - 2u - 2o - 2u - o - u - o$.
$2'$. $(i = 0)$: $u - o - u - 2o - 2u - 2o - 2u - 2o$.
$3'$. $(i = 0)$: $2u - 2o - 2u - 2o - 2u - o - u - o$.

$4'$. $(i \leq 1)$: $2u - o - u - 2o - 2u - 2o - 2u - 2o$.
$5'$. $(i \leq 1)$: $2u - 3o - 2u - 2o - 2u - o - u - o$.
$6'$. $(i \leq 2)$: $2u - 2o - u - 2o - 2u - 2o - 2u - 2o$.
$7'$. $(i \leq 2)$: $2u - 3o - 3u - 2o - 2u - o - u - o$.
$8'$. $(i \leq 3)$: $2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o$.
$9'$. $(i \leq 3)$: $2u - 3o - 3u - 3o - 2u - o - u - o$.
$10'$. $(i \leq 4)$: $2u - 2o - 2u - 3o - 2u - 2o - 2u - 2o$.
$11'$. $(i \leq 4)$: $2u - 3o - 3u - 3o - 3u - o - u - o$.
$12'$. $(i \leq 5)$: $2u - 2o - 2u - 3o - 3u - 2o - 2u - 2o$.
$13'$. $(i \leq 5)$: $2u - 3o - 3u - 3o - 3u - 2o - u - o$.
$14'$. $(i \leq 6)$: $2u - 2o - 2u - 3o - 3u - 3o - 2u - 2o$.
$15'$. $(i \leq 6)$: $2u - 3o - 3u - 3o - 3u - 2o - 2u - o$.
$16'$. $(i \leq 7)$: $2u - 2o - 2u - 3o - 3u - 3o - 3u - 2o$.
$17'$. $(i \leq 7)$: $2u - 3o - 3u - 3o - 3u - 2o - 2u - 2o$.
$18'$. $(i \leq 8)$: $2u - 2o - 2u - 3o - 3u - 3o - 3u - 2o$.

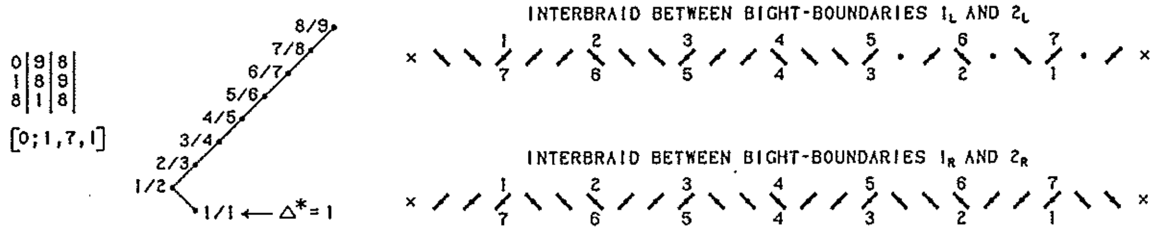

Fig. 1001 — Euclid's algorithm, path formula, path in RKT and algorithm diagrams for interbraided Regular Knots.

For the interbraided Regular Knot between the bight-boundaries 1_R and 2_R we read the following half-cycle braiding algorithms from its algorithm diagram:

$1''$. : $2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o$.
$2''$. $(i = 0)$: $2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o$.
$3''$. $(i = 0)$: $2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o$.
$4''$. $(i \leq 1)$: $3u - 2o - 2u - 2o - 2u - 2o - 2u - 2o$.
$5''$. $(i \leq 1)$: $2u - 3o - 2u - 2o - 2u - 2o - 2u - 2o$.
$6''$. $(i \leq 2)$: $3u - 3o - 2u - 2o - 2u - 2o - 2u - 2o$.
$7''$. $(i \leq 2)$: $2u - 3o - 3u - 2o - 2u - 2o - 2u - 2o$.
$8''$. $(i \leq 3)$: $3u - 3o - 3u - 2o - 2u - 2o - 2u - 2o$.
$9''$. $(i \leq 3)$: $2u - 3o - 3u - 3o - 2u - 2o - 2u - 2o$.
$10''$. $(i \leq 4)$: $3u - 3o - 3u - 3o - 2u - 2o - 2u - 2o$.
$11''$. $(i \leq 4)$: $2u - 3o - 3u - 3o - 3u - 2o - 2u - 2o$.
$12''$. $(i \leq 5)$: $3u - 3o - 3u - 3o - 3u - 2o - 2u - 2o$.
$13''$. $(i \leq 5)$: $2u - 3o - 3u - 3o - 3u - 3o - 2u - 2o$.
$14''$. $(i \leq 6)$: $3u - 3o - 3u - 3o - 3u - 3o - 2u - 2o$.
$15''$. $(i \leq 6)$: $2u - 3o - 3u - 3o - 3u - 3o - 3u - 2o$.
$16''$. $(i \leq 7)$: $3u - 3o - 3u - 3o - 3u - 3o - 3u - 2o$.
$17''$. $(i \leq 7)$: $2u - 3o - 3u - 3o - 3u - 3o - 3u - 3o$.
$18''$. $(i \leq 8)$: $3u - 3o - 3u - 3o - 3u - 3o - 3u - 2o$.

If one wants to interbraid the Regular Knot between the bight-boundaries 1_R and 2_R first, then their braiding half-cycles are the ones above for half-cycles $1'$-$18'$, while the braiding half-cycles for the Regular Knot between the bight-boundaries 1_L and 2_L are then the ones above for half-cycles $1''$-$18''$.

The Alamar Knot

In braidwork associated with *Western Horse Tack* we often encounter the name *Alamar Knot*. This knot is there not only used as a basis for decorative braids[†], but also in a halter as a non-slip knot at the left-hand and right-hand junctions between nose piece, cheek piece and curb piece.[‡]

Fig. 1002 shows the configuration of the basic Alamar Knot.

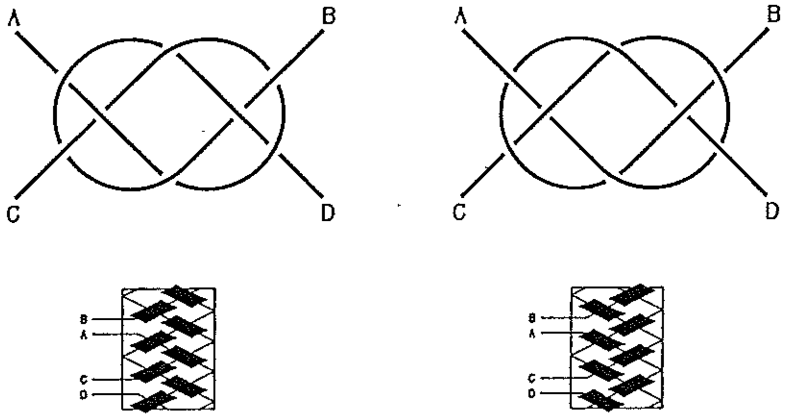

Fig. 1002 — The basic configuration of the Alamar Knot.

When the working ends are the diagonally opposite ends, it is known as the Carrick Bend or Full Carrick Bend. It is then also known as the Split Knot to the knitwear manufacturer, the Warp Knot to the sailor, and the Cowboy Knot to the cowhand.[††]

When all four ends are employed it is called the Josephine Knot.[‡‡]

When the ends *A* and *B* are connected, hence with the ends *C* and *D* free, or when the ends *C* and *D* are connected, hence with the ends *A* and *B* free, it is called the Pretzel Knot, the Austrian Knot, or the Sailor's Breastplate when the connected ends form a large enough loop to place over a person's neck.

When end *A* is connected with end *B* and end *C* with end *D*, it is the Trefoil Knot or the Three-part Four-bight under-over coded Regular Knot.

[†] See for example the *Encyclopedia of Rawhide and Leather Braiding* by Bruce Grant: pg. 286.

[‡] See *Western Tack Tips* by Tom Hall: pp. 40 and 41. It should be noted here that the so-called Hibbert Halter on pg. 40 in Tom Hall's *Western Tack Tips* is not the real Hibbert Halter under the U.S. Patent 4,106,266 of August 15, 1978.

[††] See *The Century Guide to Knots* by Mario Bigon and Guido Regazzoni, pg. 136.

[‡‡] Contrary to Clifford W. Ashley, Charles Warner in his book *A Fresh Approach to Knotting and Ropework*, pg. 181, fig. 482, calls the configuration in which both working ends are on the same side of the knot, the Josephine Knot.

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for
the braiding artisan

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Interbraided Cylindrical Braids

In *The Braider*, Issue No. 53, pg. 1265, we introduced a "new" type of Interbraided Cylindrical Braid. The helix angle of the string-run in these braids, when braided over a constant diameter, has a constant value throughout the braid. Example 3 on pg. 1265 furnished an example of such an interbraid which requires three essential strings: one for the foundation knot and one for each of the two interbraided Regular Knots. With $B_c = 3m$ for the foundation knot, where m is odd but not an odd multiple of 11, the essential number of strings for the overall interbraid remains the same. The string-run of the foundation knot in this example was depicted in the upper diagram of Fig. 997, pg. 1267. Let's now redraw this string-run so that the 18 bights on bight-boundary 1_L are regularly spaced. The bight-index number at the end of the first-return string-run will then be $2\times18+8=36+8=44$, while $C_1=C_3=9$. Hence $4C_1+C_2=36+C_2=44$, and consequently $C_2=8$. This results in the string-run depicted in Fig. 1003.

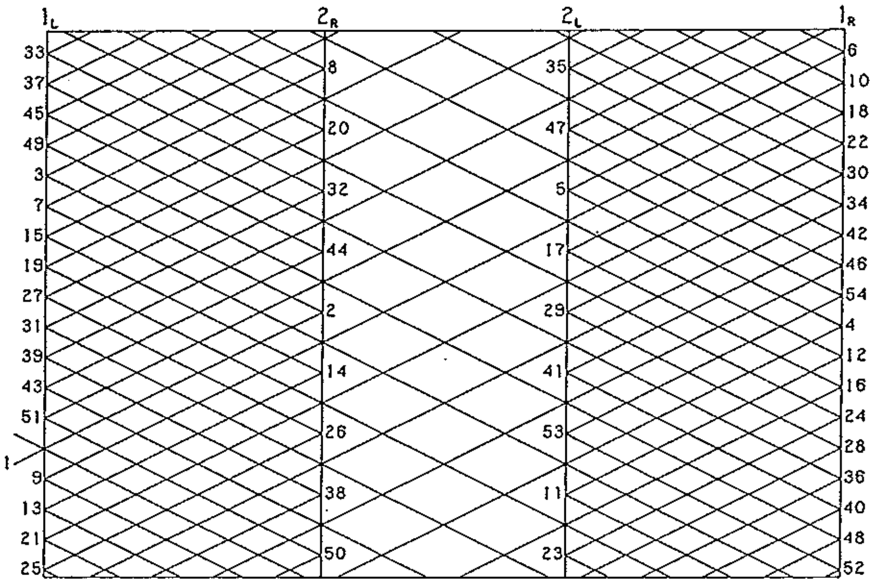

Fig. 1003 — The string-run diagram of the foundation knot.

Note that for the foundation knot in this diagram also $\beta=66$ and $B_c=27$.

It will be evident that a first-return string-run dictates that we can also obtain the value for $\lambda = \text{g.c.d.}\left(\frac{\beta}{\alpha}, \frac{B_c}{\alpha}\right)$ from $\text{g.c.d.}\left(\frac{\beta'}{\alpha'}, \frac{B_c{}'}{\alpha'}\right)$, where α' is the number of bights in the first-return string-run on the circumferencial bight-boundary n, β' is the number of bights the first-return string-run spans in the component on the circumferential bight-boundary n, and $B_c{}'$ is the component's number of bights on the circumferential bight-boundary n. The first-return string-run starts and ends on the appropriate circumferential bight-boundary n of course.

For bight-boundary 1_L we obtain $\alpha'=2$, $\beta'=2\times18+8=44$, and $B_c{}'=18$. Hence $\lambda=\text{g.c.d.}\left(\frac{44}{2}, \frac{18}{2}\right)=\text{g.c.d.}\ (22\,,\,9)=1$.

For bight-boundary 2_R we obtain $\alpha'=1$, $\beta'=2\times9+4=22$, and $B_c{}'=9$. Hence $\lambda=\text{g.c.d.}\left(\frac{22}{1}, \frac{9}{1}\right)=\text{g.c.d.}\ (22\,,\,9)=1$.

For bight-boundary 2_L we obtain $\alpha'=1$, $\beta'=2\times9+4=22$, and $B_c{}'=9$. Hence

$\lambda = \text{g.c.d.}\left(\frac{22}{1}, \frac{9}{1}\right) = \text{g.c.d.}\ (22, 9) = 1$.

For bight-boundary 1_R we obtain $\alpha' = 2$, $\beta' = 2 \times 18 + 8 = 44$, and $B_c{}' = 18$. Hence $\lambda = \text{g.c.d.}\left(\frac{44}{2}, \frac{18}{2}\right) = \text{g.c.d.}\ (22, 9) = 1$.

Note that it is simpler to calculate the value for λ with α', β' and $B_c{}'$ than with α, β, and B_c.

The foundation knot in Fig. 1003 can be interbraided with a Regular Knot of which the string-run is shown in Fig. 1004. Hence the overall interbraid requires two essential strings: one for the foundation knot and one for the interbraided Regular Knot.

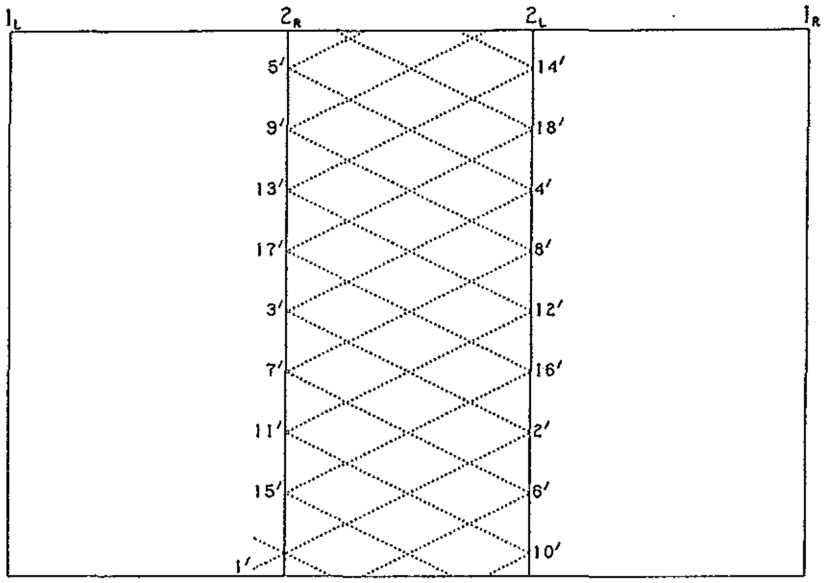

Fig. 1004 — The string-run of the interbraided Regular Knot.

Fig. 1005 shows a coding superimposed on the string-runs of Figs. 1003 and 1004.

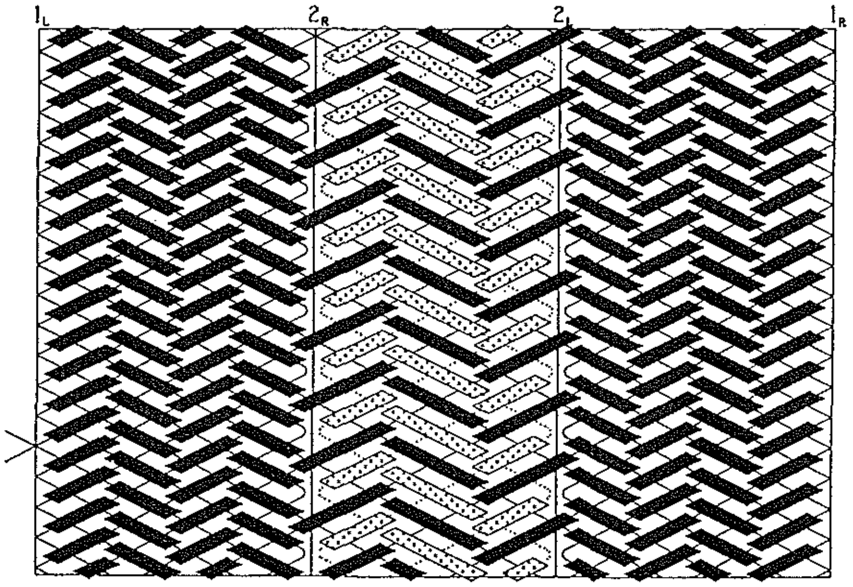

Fig. 1005 — A coding superimposed on the string-runs in Figs. 1003 and 1004.

The half-cycle braiding algorithms for the foundation knot can be read from the tables in Figs. 1006 & 1007. In these tables, half-cycle n intersects the half-cycles which end at the beginning of the half-cycles $\leq n$ listed on their right. These tables give us the following half-cycle braiding algorithms:

1. $1_L \longrightarrow 2_R$: Free run.
2. $2_R \longrightarrow 1_L$: Free run.
3. $1_L \longrightarrow 1_R$: Free run.
4. $1_R \longrightarrow 2_L$: Free run.
5. $2_L \longrightarrow 1_R$: Free run.
6. $1_R \longrightarrow 1_L$: $u - o$.
7. $1_L \longrightarrow 2_R$: o.
8. $2_R \longrightarrow 1_L$: o.
9. $1_L \longrightarrow 1_R$: $o - u$.
10. $1_R \longrightarrow 2_L$: u.
11. $2_L \longrightarrow 1_R$: u.
12. $1_R \longrightarrow 1_L$: $2u - 2o$.
13. $1_L \longrightarrow 2_R$: o.
14. $2_R \longrightarrow 1_L$: $2o$.
15. $1_L \longrightarrow 1_R$: $3o - 2u$.
16. $1_R \longrightarrow 2_L$: $2u$.
17. $2_L \longrightarrow 1_R$: $2u$.
18. $1_R \longrightarrow 1_L$: $4u - 2o - u$.

HALF-CYCLE								
1	51	43	39	31	27	19	15	7
7	3	49	45	37	33	25	21	13
13	9	✕	51	43	39	31	27	19
19	15	7	3	49	45	37	33	25
25	21	13	9	✕	51	43	39	31
31	27	19	15	7	3	49	45	37
37	33	25	21	13	9	✕	51	43
43	39	31	27	19	15	7	3	49
49	45	37	33	25	21	13	9	✕
	0	0	U	U	0	0	U	U

HALF-CYCLE								
5	✕	47	43	35	31	23	19	11
11	7	53	49	41	37	29	25	17
17	13	5	✕	47	43	35	31	23
23	19	11	7	53	49	41	37	29
29	25	17	13	5	✕	47	43	35
35	31	23	19	11	7	53	49	41
41	37	29	25	17	13	5	✕	47
47	43	35	31	23	19	11	7	53
53	49	41	37	29	25	17	13	5
	U	U	0	0	U	U	0	0

HALF-CYCLE																					
3	49	45	37	33	25	21	13	9	✕	43	31	19	7	53	49	41	37	29	25	17	13
9	✕	51	43	39	31	27	19	15	7	49	37	25	13	5	✕	47	43	35	31	23	19
15	7	3	49	45	37	33	25	21	13	✕	43	31	19	11	7	53	49	41	37	29	25
21	13	9	✕	51	43	39	31	27	19	7	49	37	25	17	13	5	✕	47	43	35	31
27	19	15	7	3	49	45	37	33	25	13	✕	43	31	23	19	11	7	53	49	41	37
33	25	21	13	9	✕	51	43	39	31	19	7	49	37	29	25	17	13	5	✕	47	43
39	31	27	19	15	7	3	49	45	37	25	13	✕	43	35	31	23	19	11	7	53	49
45	37	33	25	21	13	9	✕	51	43	31	19	7	49	41	37	29	25	17	13	5	✕
51	43	39	31	27	19	15	7	3	49	37	25	13	✕	47	43	35	31	23	19	11	7
	0	0	U	U	0	0	U	U	0	0	U	0	0	U	U	0	0	U	U	0	0

Fig. 1006 — Tables for the odd-numbered half-cycles.

19. $1_L \longrightarrow 2_R$: $2o - u$.
20. $2_R \longrightarrow 1_L$: $2o - u$.
21. $1_L \longrightarrow 1_R$: $4o - 2u - o$.

22. $1_R \longrightarrow 2_L$: $2u - o$.
23. $2_L \longrightarrow 1_R$: $2u - o$.
24. $1_R \longrightarrow 1_L$: $2u - o - 2u - 2o - 2u$.
25. $1_L \longrightarrow 2_R$: $2o - u$.
26. $2_R \longrightarrow 1_L$: $2o - 2u$.
27. $1_L \longrightarrow 1_R$: $2o - 2u - 2o - 2u - 2o$.
28. $1_R \longrightarrow 2_L$: $2u - 2o$.
29. $2_L \longrightarrow 1_R$: $2u - 2o$.
30. $1_R \longrightarrow 1_L$: $2u - 2o - 2u - 3o - 2u - o$.
31. $1_L \longrightarrow 2_R$: $2o - 2u - o$.
32. $2_R \longrightarrow 1_L$: $2o - 2u - o$.
33. $1_L \longrightarrow 1_R$: $2o - 2u - 2o - 3u - 2o - u$.
34. $1_R \longrightarrow 2_L$: $2u - 2o - u$.
35. $2_L \longrightarrow 1_R$: $2u - 2o - u$.
36. $1_R \longrightarrow 1_L$: $2u - 2o - 3u - 3o - 2u - 2o$.
37. $1_L \longrightarrow 2_R$: $2o - 2u - o$.
38. $2_R \longrightarrow 1_L$: $2o - 2u - 2o$.
39. $1_L \longrightarrow 1_R$: $2o - 2u - 4o - 3u - 2o - 2u$.
40. $1_R \longrightarrow 2_L$: $2u - 2o - 2u$.

HALF-CYCLE								
2	52	44	40	32	28	20	16	8
8	4	50	46	38	34	26	22	14
14	10	2	52	44	40	32	28	20
20	16	8	4	50	46	38	34	26
26	22	14	10	2	52	44	40	32
32	28	20	16	8	4	50	46	38
38	34	26	22	14	10	2	52	44
44	40	32	28	20	16	8	4	50
50	46	38	34	26	22	14	10	2
	O	O	U	U	O	O	U	U

HALF-CYCLE								
4	54	46	42	34	30	22	18	10
10	6	52	48	40	36	28	24	16
16	12	4	54	46	42	34	30	22
22	18	10	6	52	48	40	36	28
28	24	16	12	4	54	46	42	34
34	30	22	18	10	6	52	48	40
40	36	28	24	16	12	4	54	46
46	42	34	30	22	18	10	6	52
52	48	40	36	28	24	16	12	4
	U	U	O	O	U	U	O	O

HALF-CYCLE																					
6	52	48	40	36	28	24	16	12	4	46	34	22	10	2	52	44	40	32	28	20	16
12	4	54	46	42	34	30	22	18	10	52	40	28	16	8	4	50	46	38	34	26	22
18	10	6	52	48	40	36	28	24	16	4	46	34	22	14	10	2	52	44	40	32	28
24	16	12	4	54	46	42	34	30	22	10	52	40	28	20	16	8	4	50	46	38	34
30	22	18	10	6	52	48	40	36	28	16	4	46	34	26	22	14	10	2	52	44	40
36	28	24	16	12	4	54	46	42	34	22	10	52	40	32	28	20	16	8	4	50	46
42	34	30	22	18	10	6	52	48	40	28	16	4	46	38	34	26	22	14	10	2	52
48	40	36	28	24	16	12	4	54	46	34	22	10	52	44	40	32	28	20	16	8	4
54	46	42	34	30	22	18	10	6	52	40	28	16	4	50	46	38	34	26	22	14	10
	U	U	O	O	U	U	O	O	U	U	O	U	U	O	O	U	U	O	O	U	U

Fig. 1007 — Tables for the even-numbered half-cycles.

41. $2_L \longrightarrow 1_R$: $2u - 2o - 2u$.
42. $1_R \longrightarrow 1_L$: $2u - 2o - 4u - o - u - 2o - 2u - 2o - u$.
43. $1_L \longrightarrow 2_R$: $2o - 2u - 2o - u$.
44. $2_R \longrightarrow 1_L$: $2o - 2u - 2o - u$.

45. $1_L \longrightarrow 1_R$: $2o - 2u - 4o - u - o - 2u - 2o - 2u - o$.
46. $1_R \longrightarrow 2_L$: $2u - 2o - 2u - o$.
47. $2_L \longrightarrow 1_R$: $2u - 2o - 2u - o$.
48. $1_R \longrightarrow 1_L$: $2u - 2o - 2u - o - 2u - o - u - 2o - 2u - 2o - 2u$.
49. $1_L \longrightarrow 2_R$: $2o - 2u - 2o - u$.
50. $2_R \longrightarrow 1_L$: $2o - 2u - 2o - 2u$.
51. $1_L \longrightarrow 1_R$: $2o - 2u - 2o - 2u - 2o - u - o - 2u - 2o - 2u - 2o$.
52. $1_R \longrightarrow 2_L$: $2u - 2o - 2u - 2o$.
53. $2_L \longrightarrow 1_R$: $2u - 2o - 2u - 2o$.
54. $1_R \longrightarrow 1_L$: $2u - 2o - 2u - 2o - 2u - o - 2u - 2o - 2u - 2o - 2u$.

Note that the entries in the body of the tables in Figs. 1006 & 1007 are identical to the entries in the body of the tables in Figs. 999 & 1000; it are only the coding entries which differ.

Euclid's algorithm, the path formula, the path in the RKT for the interbraided Regular Knot and its associated algorithm diagram are shown in Fig. 1008. For the interbraided Regular Knot (between the bight-boundaries 2_R and 2_L) we read the following half-cycle braiding algorithms from its algorithm diagram:

1′. : $o - 2u - o$.
2′. $(i = 0)$: $u - 2o - u$.
3′. $(i = 0)$: $o - 2u - o$.
4′. $(i \leq 1)$: $u - 2o - u$.
5′. $(i \leq 1)$: $o - 2u - o$.
6′. $(i \leq 2)$: $2u - 2o - u$.
7′. $(i \leq 2)$: $2o - 2u - o$.
8′. $(i \leq 3)$: $2u - 2o - u$.
9′. $(i \leq 3)$: $2o - 2u - o$.
10′. $(i \leq 4)$: $2u - 3o - u$.
11′. $(i \leq 4)$: $2o - 3u - o$.
12′. $(i \leq 5)$: $2u - 3o - u$.
13′. $(i \leq 5)$: $2o - 3u - o$.
14′. $(i \leq 6)$: $2u - 3o - 2u$.
15′. $(i \leq 6)$: $2o - 3u - 2o$.
16′. $(i \leq 7)$: $2u - 3o - 2u$.
17′. $(i \leq 7)$: $2o - 3u - 2o$.
18′. $(i \leq 8)$: $2u - 3o - 2u$.

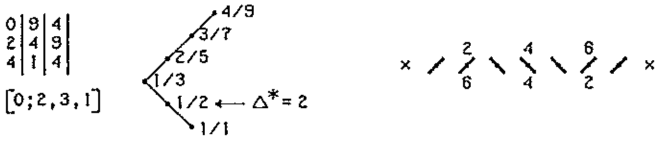

Fig. 1008 — Euclid's algorithm, path formula, path in RKT and algorithm diagram for interbraided Regular Knot.

Let the first-return string-run of a component in a cylindrical braid be as shown in Fig. 1009. In this diagram the bight-index numbers associated with the intersection points between the first-return string-run and the bight-boundaries are indicated. Thus for this component $\beta = 2C_1 + 3C_2 + 2C_3$ while $\alpha = 3$. Let's take $C_1 = C_3$, then $\beta = 4C_1 + 3C_2 = 4C_3 + 3C_2$.

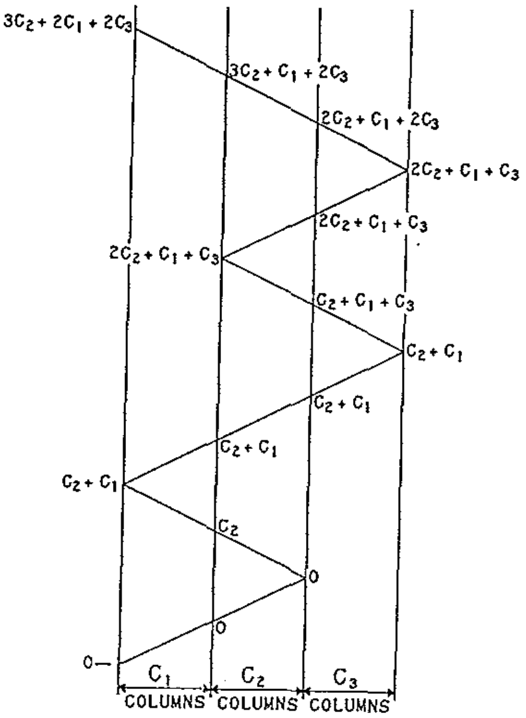

Fig. 1009 — The first-return string-run of a component in a cylindrical braid.

Example 1.

Let $C_1 = C_3 = 15$ and $C_2 = 10$, then $\beta = 4 \times 15 + 3 \times 10 = 90$. Note that C_1, C_2 and C_3 must be chosen so that β is divisible by $\alpha = 3$.

Let $B_c = 21$. Note that B_c must be chosen so that B_c is divisible by $\alpha = 3$.

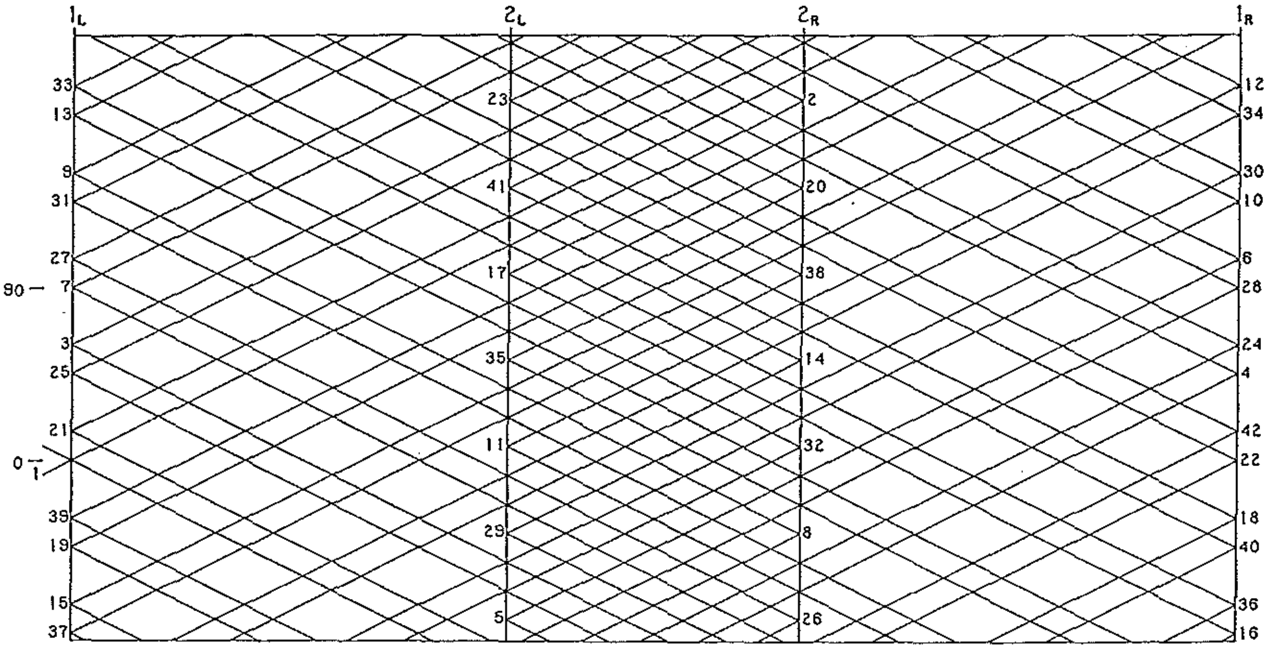

Fig. 1010 — The string-run of the foundation braid.

Thus for this component we obtain:

$$\lambda = \text{g.c.d.}\left(\frac{\beta}{\alpha}, \frac{B_c}{\alpha}\right) = \text{g.c.d.}\left(\frac{90}{3}, \frac{21}{3}\right) = \text{g.c.d.}\ (30\,, 7) = 1\,,$$

and hence only one essential string is required.

The string-run of this component consist of $\left(\dfrac{B_c}{\alpha}\right) = \left(\dfrac{21}{3}\right) = 7$ consecutive first-return string-runs.

The diagram in Fig. 1010 depicts the string-run of the foundation braid.

This foundation braid can be interbraided with two Regular Cylindrical Braids, one between the two leftmost bight-boundaries and one between the two rightmost bight-boundaries. For each of these two Regular Cylindrical Braids $p = 5$ and $b = 7$. Hence each braid is a Regular Knot and thus requires only one essential string.

Fig. 1011 depicts the string-runs of the two interbraided Regular Knots.

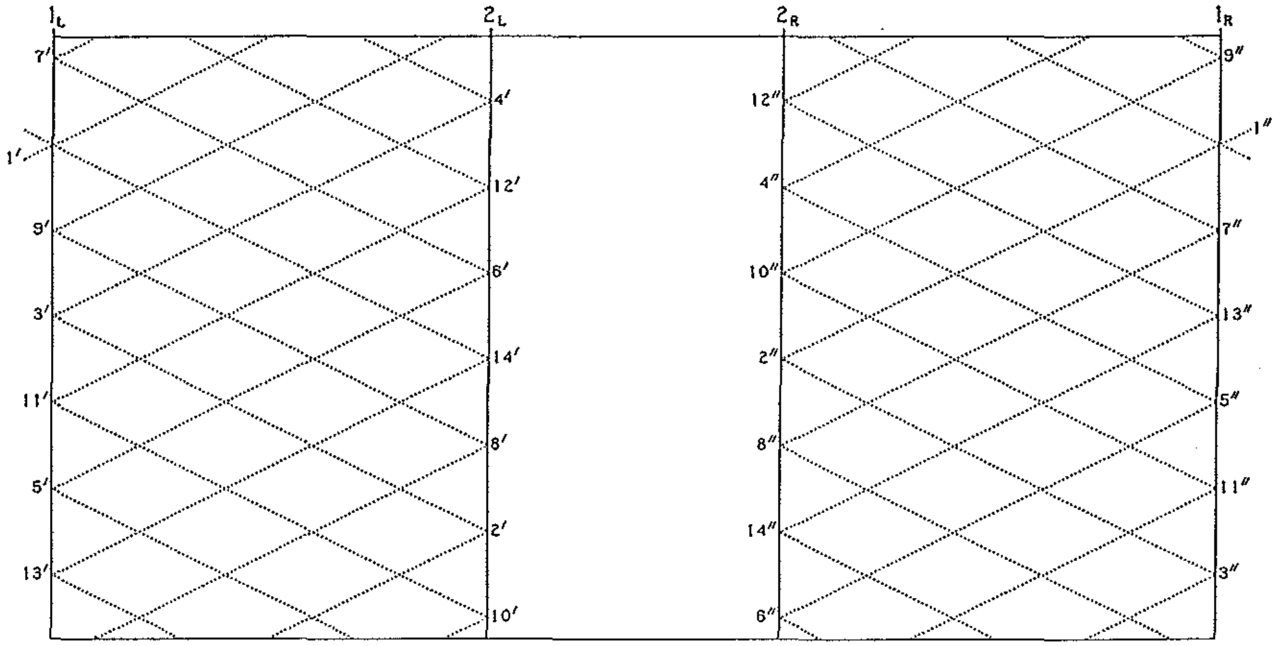

Fig. 1011 — The string-runs of the two interbraided Regular Knots.

A superimposed coding on the three string-runs is shown in Fig. 1012.

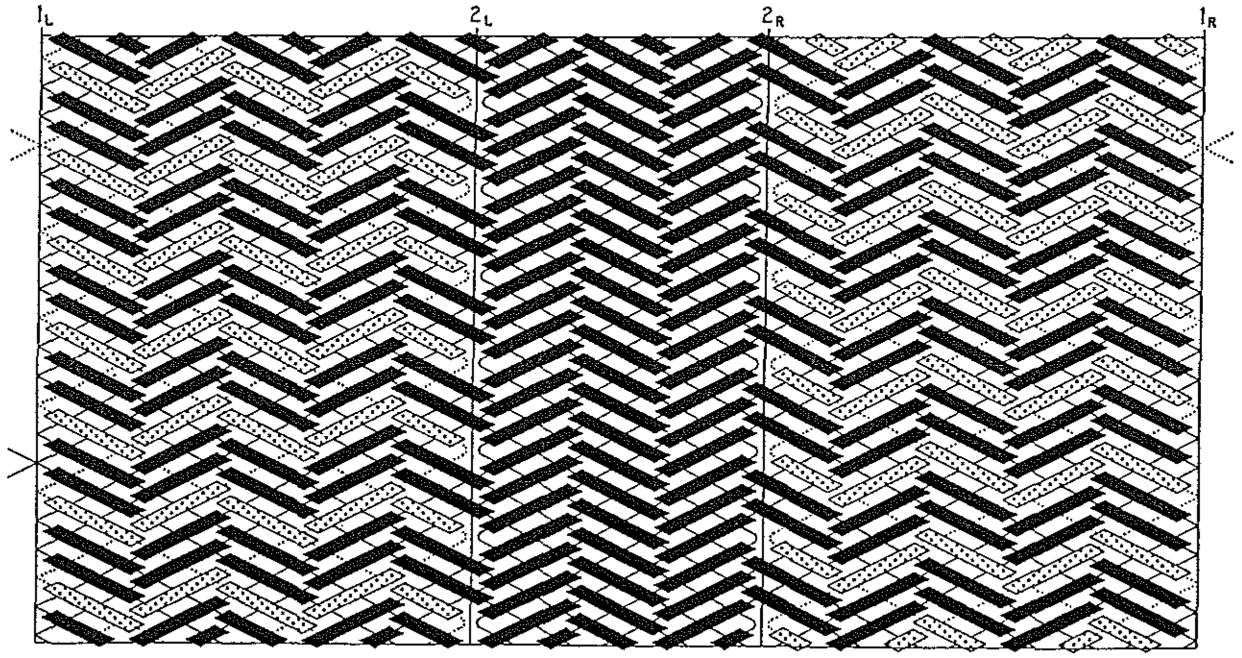

Fig. 1012 — A coding superimposed on the string-runs.

The half-cycle braiding algorithms for the foundation knot can be read from the tables in Figs. 1013 & 1014. In these tables, half-cycle n intersects the half-cycles which end at the beginning of the half-cycles $\leq n$ listed on their right.

From the tables in Figs. 1013 & 1014 we read the following half-cycle braiding algorithms:

1. $1_L \longrightarrow 2_R$: Free run.
2. $2_R \longrightarrow 1_L$: u.
3. $1_L \longrightarrow 1_R$: u.
4. $1_R \longrightarrow 2_L$: $u - o$.
5. $2_L \longrightarrow 1_R$: $2o$.
6. $1_R \longrightarrow 1_L$: $u - o - u - o$.
7. $1_L \longrightarrow 2_R$: $o - 2u$.

HALF-CYCLE																			
1	21	25	3	7	27	31	9	13	33	37	15	41	19	39	23	☒	21	5	25
7	27	31	9	13	33	37	15	19	39	☒	21	5	25	3	29	7	27	11	31
13	33	37	15	19	39	☒	21	25	3	7	27	11	31	9	35	13	33	17	37
19	39	☒	21	25	3	7	27	31	9	13	33	17	37	15	41	19	39	23	☒
25	3	7	27	31	9	13	33	37	15	19	39	23	☒	21	5	25	3	29	7
31	9	13	33	37	15	19	39	☒	21	25	3	29	7	27	11	31	9	35	13
37	15	19	39	☒	21	25	3	7	27	31	9	35	13	33	17	37	15	41	19
	U	U	O	O	U	U	O	O	U	U	O	O	O	U	U	U	O	O	O

HALF-CYCLE																			
5	25	3	29	7	27	11	31	9	35	13	17	37	41	19	23	☒	5	25	29
11	31	9	35	13	33	17	37	15	41	19	23	☒	5	25	29	7	11	31	35
17	37	15	41	19	39	23	☒	21	5	25	29	7	11	31	35	13	17	37	41
23	☒	21	5	25	3	29	7	27	11	31	35	13	17	37	41	19	23	☒	5
29	7	27	11	31	9	35	13	33	17	37	41	19	23	☒	5	25	29	7	11
35	13	33	17	37	15	41	19	39	23	☒	5	25	29	7	11	31	35	13	17
41	19	39	23	☒	21	5	25	3	29	7	11	31	35	13	17	37	41	19	23
	O	O	O	U	U	U	O	O	O	U	U	O	O	U	U	O	O	U	U

HALF-CYCLE																													
3	7	27	31	9	13	33	37	15	19	39	23	☒	21	5	25	3	29	7	27	11	31	35	13	17	37	41	19	23	☒
9	13	33	37	15	19	39	☒	21	25	3	29	7	27	11	31	9	35	13	33	17	37	41	19	23	☒	5	25	29	7
15	19	39	☒	21	25	3	7	27	31	9	35	13	33	17	37	15	41	19	39	23	☒	5	25	29	7	11	31	35	13
21	25	3	7	27	31	9	13	33	37	15	41	19	39	23	☒	21	5	25	3	29	7	11	31	35	13	17	37	41	19
27	31	9	13	33	37	15	19	39	☒	21	5	25	3	29	7	27	11	31	9	35	13	17	37	41	19	23	☒	5	25
33	37	15	19	39	☒	21	25	3	7	27	11	31	9	35	13	33	17	37	15	41	19	23	☒	5	25	29	7	11	31
39	☒	21	25	3	7	27	31	9	13	33	17	37	15	41	19	39	23	☒	21	5	25	29	7	11	31	35	13	17	37
	U	U	O	O	U	U	O	O	U	U	O	O	O	U	U	U	O	O	O	U	U	O	O	U	U	O	O	U	U

Fig. 1013 — Tables for the odd-numbered half-cycles.

8. $2_R \longrightarrow 1_L$: $4u$.
9. $1_L \longrightarrow 1_R$: $u - o - u - o - u$.
10. $1_R \longrightarrow 2_L$: $o - u - 2o$.
11. $2_L \longrightarrow 1_R$: $4o$.
12. $1_R \longrightarrow 1_L$: $u - o - u - o - u - o - u - o$.

13. $1_L \longrightarrow 2_R$: $2u - o - 2u$.
14. $2_R \longrightarrow 1_L$: $6u$.
15. $1_L \longrightarrow 1_R$: $u - o - u - o - u - o - u - o - u$.
16. $1_R \longrightarrow 2_L$: $3o - u - 2o$.
17. $2_L \longrightarrow 1_R$: $6o$.
18. $1_R \longrightarrow 1_L$: $u - o - u - o - u - o - u - o - u - o - u - o$.
19. $1_L \longrightarrow 2_R$: $4u - o - 2u$.

HALF-CYCLE																			
2	22	42	26	4	24	8	28	6	32	10	14	34	38	16	20	40	2	22	26
8	28	6	32	10	30	14	34	12	38	16	20	40	2	22	26	4	8	28	32
14	34	12	38	16	36	20	40	18	2	22	26	4	8	28	32	10	14	34	38
20	40	18	2	22	42	26	4	24	8	28	32	10	14	34	38	16	20	40	2
26	4	24	8	28	6	32	10	30	14	34	38	16	20	40	2	22	26	4	8
32	10	30	14	34	12	38	16	36	20	40	2	22	26	4	8	28	32	10	14
38	16	36	20	40	18	2	22	42	26	4	8	28	32	10	14	34	38	16	20
	U	U	U	O	O	O	U	U	U	O	O	U	U	O	O	U	U	O	O

HALF-CYCLE																			
4	24	28	6	10	30	34	12	16	36	40	18	2	22	42	26	4	24	8	28
10	30	34	12	16	36	40	18	22	42	4	24	8	28	6	32	10	30	14	34
16	36	40	18	22	42	4	24	28	6	10	30	14	34	12	38	16	36	20	40
22	42	4	24	28	6	10	30	34	12	16	36	20	40	18	2	22	42	26	4
28	6	10	30	34	12	16	36	40	18	22	42	26	4	24	8	28	6	32	10
34	12	16	36	40	18	22	42	4	24	28	6	32	10	30	14	34	12	38	16
40	18	22	42	4	24	28	6	10	30	34	12	38	16	36	20	40	18	2	22
	O	O	U	U	O	O	U	U	O	O	U	U	U	O	O	O	U	U	U

HALF-CYCLE																													
6	10	30	34	12	16	36	40	18	22	42	26	4	24	8	28	6	32	10	30	14	34	38	16	20	40	2	22	26	4
12	16	36	40	18	22	42	4	24	28	6	32	10	30	14	34	12	38	16	36	20	40	2	22	26	4	8	28	32	10
18	22	42	4	24	28	6	10	30	34	12	38	16	36	20	40	18	2	22	42	26	4	8	28	32	10	14	34	38	16
24	28	6	10	30	34	12	16	36	40	18	2	22	42	26	4	24	8	28	6	32	10	14	34	38	16	20	40	2	22
30	34	12	16	36	40	18	22	42	4	24	8	28	6	32	10	30	14	34	12	38	16	20	40	2	22	26	4	8	28
36	40	18	22	42	4	24	28	6	10	30	14	34	12	38	16	36	20	40	18	2	22	26	4	8	28	32	10	14	34
42	4	24	28	6	10	30	34	12	16	36	20	40	18	2	22	42	26	4	24	8	28	32	10	14	34	38	16	20	40
	O	O	U	U	O	O	U	U	O	O	U	U	U	O	O	O	U	U	U	O	O	U	U	O	O	U	U	O	O

Fig. 1014 — Tables for the even-numbered half-cycles.

20. $2_R \longrightarrow 1_L$: $8u - o$.
21. $1_L \longrightarrow 1_R$: $u - o - u - o - u - o - u - 2o - u - o - u - o - u$.
22. $1_R \longrightarrow 2_L$: $5o - u - 3o - u$.
23. $2_L \longrightarrow 1_R$: $2o - u - 6o - u$.
24. $1_R \longrightarrow 1_L$: $o - u - o - u - o - 2u - 2o - 2u - o - u - o - u - 2o$.
25. $1_L \longrightarrow 2_R$: $6u - o - 3u - 2o$.
26. $2_R \longrightarrow 1_L$: $3u - o - 4u - o - 2u - 2o$.
27. $1_L \longrightarrow 1_R$: $u - o - u - o - u - 3o - 2u - 2o - u - o - u - o - 2u$.
28. $1_R \longrightarrow 2_L$: $6o - 2u - 3o - 2u$.
29. $2_L \longrightarrow 1_R$: $3o - u - 4o - u - 2o - 2u$.

30. $1_R \longrightarrow 1_L$: $o - u - o - u - 2o - 3u - 2o - 2u - o - u - 2o - 2u - 2o$.
31. $1_L \longrightarrow 2_R$: $6u - 3o - 3u - 2o$.
32. $2_R \longrightarrow 1_L$: $3u - o - 2u - o - 2u - 2o - 2u - 2o$.
33. $1_L \longrightarrow 1_R$: $u - o - u - 2o - 2u - 3o - 2u - 2o - u - o - 2u - 2o - 2u$.
34. $1_R \longrightarrow 2_L$: $4o - u - 2o - 3u - 3o - 2u$.
35. $2_L \longrightarrow 1_R$: $3o - u - 2o - u - 2o - 2u - 2o - 2u$.
36. $1_R \longrightarrow 1_L$: $o - u - 2o - 2u - 2o - 3u - 2o - 2u - 2o - 2u - 2o - 2u - 2o$.
37. $1_L \longrightarrow 2_R$: $4u - 2o - 2u - 3o - 3u - 2o$.
38. $2_R \longrightarrow 1_L$: $3u - 2o - 2u - 2o - 2u - 2o - 2u - 2o$.
39. $1_L \longrightarrow 1_R$: $u - 2o - 2u - 2o - 2u - 3o - 2u - 2o - 2u - 2o - 2u - 2o - 2u$.
40. $1_R \longrightarrow 2_L$: $2o - u - 2o - 2u - 2o - 3u - 3o - 3u$.
41. $2_L \longrightarrow 1_R$: $3o - 2u - 3o - 2u - 2o - 2u - 2o - 2u$.
42. $1_R \longrightarrow 1_L$: $2o - 2u - 2o - 2u - 2o - 3u - 3o - 3u - 2o - 2u - 2o - 2u - 2o$.

Euclid's algorithm, the path formula, the path in the RKT for the interbraided Regular Knots and their algorithm diagrams are shown in Fig. 1015.

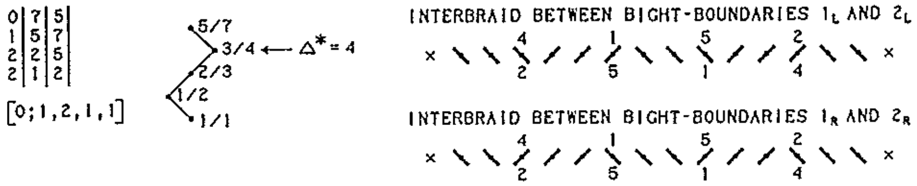
0 7 5
1 5 7
2 2 5
2 1 2
[0;1,2,1,1]
5/7
3/4
Δ* = 4
2/3
1/2
1/1
INTERBRAID BETWEEN BIGHT-BOUNDARIES 1L AND 2L
4 1 5 2
2 5 1 4
INTERBRAID BETWEEN BIGHT-BOUNDARIES 1R AND 2R
4 1 5 2
2 5 1 4

Fig. 1015 — Euclid's algorithm, path formula, path in RKT and algorithm diagrams for interbraided Regular Knots.

For the interbraided Regular Knot between the bight-boundaries 1_L and 2_L we read the following half-cycle braiding algorithms from its algorithm diagram:

1′. : $2u - 2o - 2u - 2o - 2u$.
2′. $(i = 0)$: $2o - 2u - 2o - 2u - 2o$.
3′. $(i = 0)$: $2u - 2o - 2u - 2o - 2u$.
4′. $(i \leq 1)$: $2o - 2u - 3o - 2u - 2o$.
5′. $(i \leq 1)$: $2u - 3o - 2u - 2o - 2u$.
6′. $(i \leq 2)$: $2o - 2u - 3o - 2u - 3o$.
7′. $(i \leq 2)$: $2u - 3o - 2u - 3o - 2u$.
8′. $(i \leq 3)$: $2o - 2u - 3o - 2u - 3o$.
9′. $(i \leq 3)$: $2u - 3o - 2u - 3o - 2u$.
10′. $(i \leq 4)$: $2o - 3u - 3o - 2u - 3o$.
11′. $(i \leq 4)$: $3u - 3o - 2u - 3o - 2u$.
12′. $(i \leq 5)$: $2o - 3u - 3o - 3u - 3o$.
13′. $(i \leq 5)$: $3u - 3o - 3u - 3o - 2u$.
14′. $(i \leq 6)$: $2o - 3u - 3o - 3u - 3o$.

The half-cycle braiding algorithms for the half-cycles 1″-14″ of the interbraided Regular Knot between the bight-boundaries 1_R and 2_R are identical to the ones above for the half-cycles 1′-14′ of the interbraided Regular Knot between the bight-boundaries 1_L and 2_L.

Example 2.

A further two coding arrangements on the string-runs in Figs. 1010 and 1011 are depicted in Figs. 1016 and 1017.

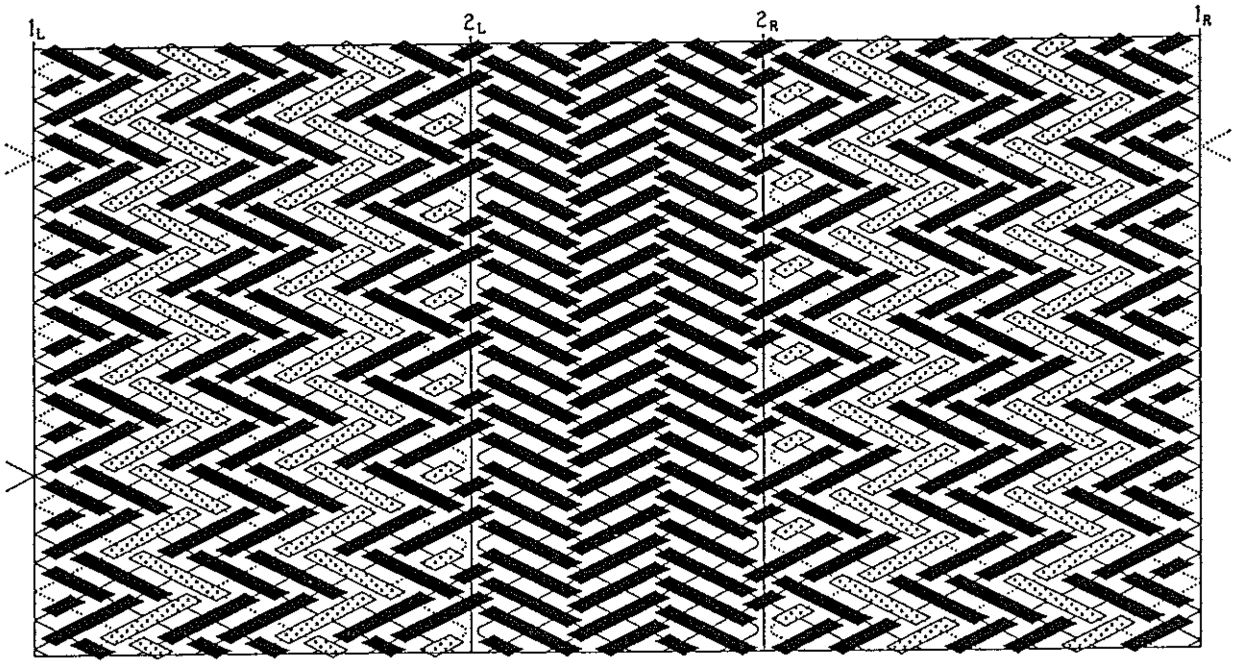

Fig. 1016 — An alternative coding arrangement on the string-runs in Figs. 1010 and 1011.

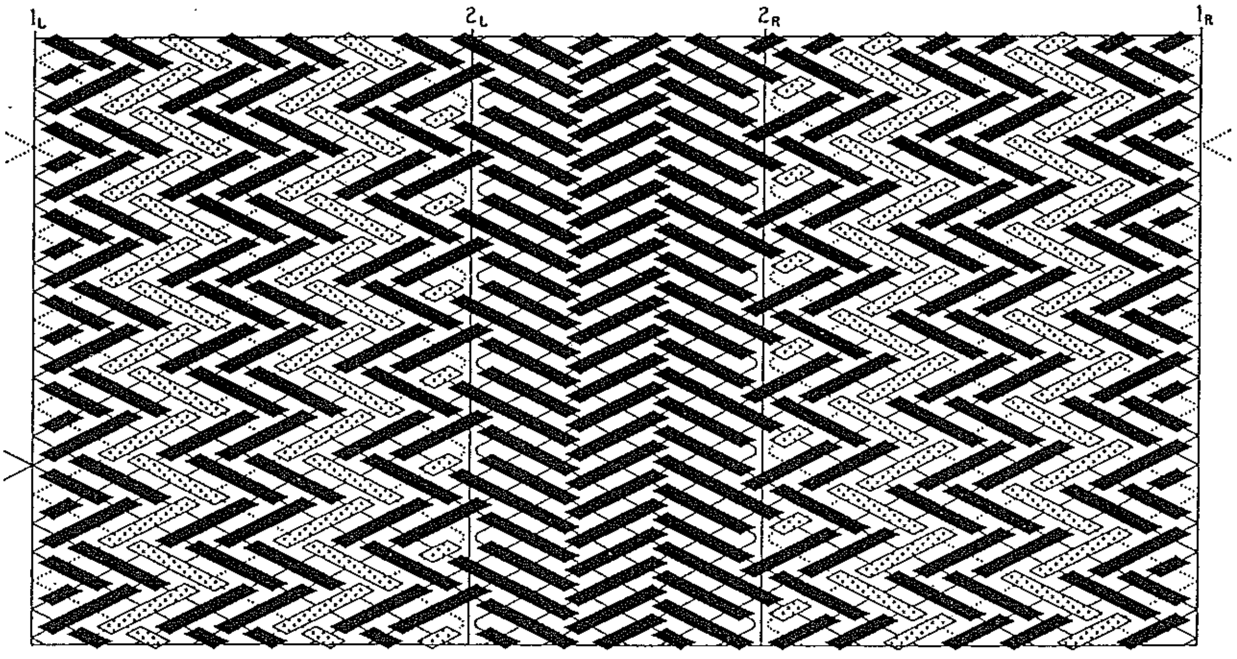

Fig. 1017 — An alternative coding arrangement on the string-runs in Figs. 1010 and 1011.

The half-cycle braiding algorithms for the foundation braid in Fig. 1016 are read from the tables in Figs. 1018 & 1019, and are as follows:

1. $1_L \longrightarrow 2_R$: Free run.
2. $2_R \longrightarrow 1_L$: o.
3. $1_L \longrightarrow 1_R$: o.
4. $1_R \longrightarrow 2_L$: $o - u$.
5. $2_L \longrightarrow 1_R$: $2u$.

6. $1_R \longrightarrow 1_L$: $o-u-2o$.
7. $1_L \longrightarrow 2_R$: $u-2o$.
8. $2_R \longrightarrow 1_L$: $2o-u-o$.
9. $1_L \longrightarrow 1_R$: $o-u-2o-u$.

HALF-CYCLE																		
1	21	25	3	7	27	31	9	13	33	37	15	41	19	39	23	X	21	5	25
7	27	31	9	13	33	37	15	19	39	X	21	5	25	3	29	7	27	11	31
13	33	37	15	19	39	X	21	25	3	7	27	11	31	9	35	13	33	17	37
19	39	X	21	25	3	7	27	31	9	13	33	17	37	15	41	19	39	23	X
25	3	7	27	31	9	13	33	37	15	19	39	23	X	21	5	25	3	29	7
31	9	13	33	37	15	19	39	X	21	25	3	29	7	27	11	31	9	35	13
37	15	19	39	X	21	25	3	7	27	31	9	35	13	33	17	37	15	41	19
	O	O	U	U	O	O	U	U	O	O	U	U	U	O	O	O	U	U	U

HALF-CYCLE																		
5	25	3	29	7	27	11	31	9	35	13	17	37	41	19	23	X	5	25	29
11	31	9	35	13	33	17	37	15	41	19	23	X	5	25	29	7	11	31	35
17	37	15	41	19	39	23	X	21	5	25	29	7	11	31	35	13	17	37	41
23	X	21	5	25	3	29	7	27	11	31	35	13	17	37	41	19	23	X	5
29	7	27	11	31	9	35	13	33	17	37	41	19	23	X	5	25	29	7	11
35	13	33	17	37	15	41	19	39	23	X	5	25	29	7	11	31	35	13	17
41	19	39	23	X	21	5	25	3	29	7	11	31	35	13	17	37	41	19	23
	U	U	U	O	O	O	U	U	U	O	O	U	U	O	O	U	U	O	O

HALF-CYCLE																													
3	7	27	31	9	13	33	37	15	19	39	23	X	21	5	25	3	29	7	27	11	31	35	13	17	37	41	19	23	X
9	13	33	37	15	19	39	X	21	25	3	29	7	27	11	31	9	35	13	33	17	37	41	19	23	X	5	25	29	7
15	19	39	X	21	25	3	7	27	31	9	35	13	33	17	37	15	41	19	39	23	X	5	25	29	7	11	31	35	13
21	25	3	7	27	31	9	13	33	37	15	41	19	39	23	X	21	5	25	3	29	7	11	31	35	13	17	37	41	19
27	31	9	13	33	37	15	19	39	X	21	5	25	3	29	7	27	11	31	9	35	13	17	37	41	19	23	X	5	25
33	37	15	19	39	X	21	25	3	7	27	11	31	9	35	13	33	17	37	15	41	19	23	X	5	25	29	7	11	31
39	X	21	25	3	7	27	31	9	13	33	17	37	15	41	19	39	23	X	21	5	25	29	7	11	31	35	13	17	37
	U	U	O	O	U	U	O	O	U	O	U	U	U	O	O	O	U	U	U	O	U	O	O	U	U	O	O	U	U

Fig. 1018 — Tables for the odd-numbered half-cycles.

10. $1_R \longrightarrow 2_L$: $u-o-2u$.
11. $2_L \longrightarrow 1_R$: $4u$.
12. $1_R \longrightarrow 1_L$: $2u-o-u-4o$.
13. $1_L \longrightarrow 2_R$: $2o-u-2o$.
14. $2_R \longrightarrow 1_L$: $2o-u-o-u-o$.
15. $1_L \longrightarrow 1_R$: $u-2o-u-2o-u-o-u$.
16. $1_R \longrightarrow 2_L$: $o-2u-o-2u$.
17. $2_L \longrightarrow 1_R$: $6u$.
18. $1_R \longrightarrow 1_L$: $4u-o-u-6o$.
19. $1_L \longrightarrow 2_R$: $4o-u-2o$.
20. $2_R \longrightarrow 1_L$: $4o-u-o-u-o-u$.
21. $1_L \longrightarrow 1_R$: $u-o-u-2o-u-o-3u-o-u-o-u$.
22. $1_R \longrightarrow 2_L$: $o-u-o-2u-o-3u-o$.

23. $2_L \longrightarrow 1_R$: $2u - o - 6u - o$.
24. $1_R \longrightarrow 1_L$: $5u - 2o - 2u - 6o - u - o$.
25. $1_L \longrightarrow 2_R$: $6o - u - 3o - 2u$.
26. $2_R \longrightarrow 1_L$: $3o - u - 2o - u - o - 2u - 2o - u$.
27. $1_L \longrightarrow 1_R$: $u - o - u - 2o - 3u - 2o - 3u - o - u - o - 2u$.
28. $1_R \longrightarrow 2_L$: $u - o - u - o - 2u - 2o - 3u - 2o$.
29. $2_L \longrightarrow 1_R$: $3u - o - 4u - o - 2u - 2o$.

HALF-CYCLE																			
2	22	42	26	4	24	8	28	6	32	10	14	34	38	16	20	40	2	22	26
8	28	6	32	10	30	14	34	12	38	16	20	40	2	22	26	4	8	28	32
14	34	12	38	16	36	20	40	18	2	22	26	4	8	28	32	10	14	34	38
20	40	18	2	22	42	26	4	24	8	28	32	10	14	34	38	16	20	40	2
26	4	24	8	28	6	32	10	30	14	34	38	16	20	40	2	22	26	4	8
32	10	30	14	34	12	38	16	36	20	40	2	22	26	4	8	28	32	10	14
38	16	36	20	40	18	2	22	42	26	4	8	28	32	10	14	34	38	16	20
	O	O	O	U	U	U	O	O	O	U	U	U	O	O	U	U	O	O	U

HALF-CYCLE																			
4	24	28	6	10	30	34	12	16	36	40	18	2	22	42	26	4	24	8	28
10	30	34	12	16	36	40	18	22	42	4	24	8	28	6	32	10	30	14	34
16	36	40	18	22	42	4	24	28	6	10	30	14	34	12	38	16	36	20	40
22	42	4	24	28	6	10	30	34	12	16	36	20	40	18	2	22	42	26	4
28	6	10	30	34	12	16	36	40	18	22	42	26	4	24	8	28	6	32	10
34	12	16	36	40	18	22	42	4	24	28	6	32	10	30	14	34	12	38	16
40	18	22	42	4	24	28	6	10	30	34	12	38	16	36	20	40	18	2	22
	U	O	O	U	U	O	O	U	U	U	O	O	O	U	U	U	O	O	O

HALF-CYCLE																													
6	10	30	34	12	16	36	40	18	22	42	26	4	24	8	28	6	32	10	30	14	34	38	16	20	40	2	22	26	4
12	16	36	40	18	22	42	4	24	28	6	32	10	30	14	34	12	38	16	36	20	40	2	22	26	4	8	28	32	10
18	22	42	4	24	28	6	10	30	34	12	38	16	36	20	40	18	2	22	42	26	4	8	28	32	10	14	34	38	16
24	28	6	10	30	34	12	16	36	40	18	2	22	42	26	4	24	8	28	6	32	10	14	34	38	16	20	40	2	22
30	34	12	16	36	40	18	22	42	4	24	8	28	6	32	10	30	14	34	12	38	16	20	40	2	22	26	4	8	28
36	40	18	22	42	4	24	28	6	10	30	14	34	12	38	16	36	20	40	18	2	22	26	4	8	28	32	10	14	34
42	4	24	28	6	10	30	34	12	16	36	20	40	18	2	22	42	26	4	24	8	28	6	32	10	14	34	38	16	20	40
	O	U	U	O	O	U	U	O	O	U	O	O	O	U	U	U	O	O	O	U	O	O	U	U	O	O	U	U	O

Fig. 1019 — Tables for the even-numbered half-cycles.

30. $1_R \longrightarrow 1_L$: $4u - o - u - 3o - 2u - 4o - u - 2o - 2u - o$.
31. $1_L \longrightarrow 2_R$: $6o - 3u - 3o - 2u$.
32. $2_R \longrightarrow 1_L$: $3o - u - 2o - 2u - 2o - 2u - 2o - u$.
33. $1_L \longrightarrow 1_R$: $u - o - u - 2o - u - o - 3u - 2o - 3u - o - 2u - 2o - 2u$.
34. $1_R \longrightarrow 2_L$: $u - o - u - o - 3u - 3o - 3u - 2o$.
35. $2_L \longrightarrow 1_R$: $3u - o - 2u - o - 2u - 2o - 2u - 2o$.
36. $1_R \longrightarrow 1_L$: $2u - o - 2u - 2o - u - 3o - 2u - 2o - u - 2o - 2u - 2o - 2u - o$.
37. $1_L \longrightarrow 2_R$: $4o - 2u - 2o - 3u - 3o - 2u$.
38. $2_R \longrightarrow 1_L$: $3o - 2u - 2o - 3u - 2o - 2u - 2o - u$.

39. $1_L \longrightarrow 1_R$: $u - 2o - 2u - 2o - u - o - 3u - 2o - 2u - o - u - 2o - 2u - 2o - 2u$.
40. $1_R \longrightarrow 2_L$: $u - o - 2u - 2o - 3u - 3o - 3u - 3o$.
41. $2_L \longrightarrow 1_R$: $3u - 2o - 3u - 2o - 2u - 2o - 2u - 2o$.
42. $1_R \longrightarrow 1_L$: $o - 2u - 2o - 2u - 2o - u - 3o - 3u - 3o - u - 2o - 2u - 2o - 2u - o$.

Euclid's algorithm, the path formula, the path in the RKT for the interbraided Regular Knots and their algorithm diagrams are shown in Fig. 1020.

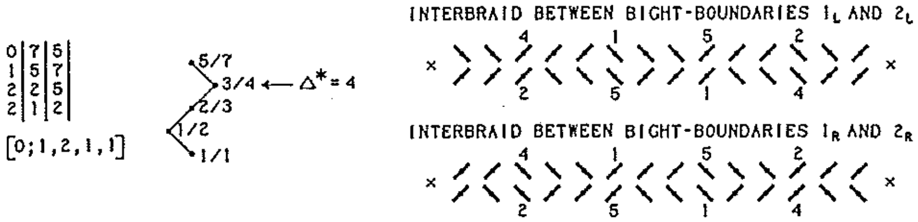
0 7 5
1 5 7
2 2 5
2 1 2
[0;1,2,1,1]
5/7
3/4 ← Δ* = 4
2/3
1/2
1/1
INTERBRAID BETWEEN BIGHT-BOUNDARIES 1L AND 2L
4 1 5 2
× ×
2 5 1 4
INTERBRAID BETWEEN BIGHT-BOUNDARIES 1R AND 2R
4 1 5 2
× ×
2 5 1 4

Fig. 1020 — Euclid's algorithm, path formula, path in RKT and algorithm diagrams for interbraided Regular Knots.

For the interbraided Regular Knot between the bight-boundaries 1_L and 2_L we read the following half-cycle braiding algorithms from its algorithm diagram:

1′. : $2u - 2o - 2u - 2o - u - o$.
2′. $(i = 0)$: $2u - 2o - 2u - 2o - 2u$.
3′. $(i = 0)$: $2u - 2o - 2u - 2o - u - o$.
4′. $(i \leq 1)$: $2u - 2o - 3u - 2o - 2u$.
5′. $(i \leq 1)$: $2u - 2o - 3u - 2o - u - o$.
6′. $(i \leq 2)$: $2u - 2o - 3u - 2o - 3u$.
7′. $(i \leq 2)$: $2u - 2o - 3u - 2o - 2u - o$.
8′. $(i \leq 3)$: $2u - 2o - 3u - 2o - 3u$.
9′. $(i \leq 3)$: $2u - 2o - 3u - 2o - 2u - o$.
10′. $(i \leq 4)$: $2u - 3o - 3u - 2o - 3u$.
11′. $(i \leq 4)$: $2u - 3o - 3u - 2o - 2u - o$.
12′. $(i \leq 5)$: $2u - 3o - 3u - 3o - 3u$.
13′. $(i \leq 5)$: $2u - 3o - 3u - 3o - 2u - o$.
14′. $(i \leq 6)$: $2u - 3o - 3u - 3o - 3u$.

The half-cycle braiding algorithms for the half-cycles 1″-14″ of the interbraided Regular Knot between the bight-boundaries 1_R and 2_R are identical to the ones above for the half-cycles 1′-14′ of the interbraided Regular Knot between the bight-boundaries 1_L and 2_L.

The half-cycle braiding algorithms for the foundation braid in Fig. 1017 are read from the tables in Figs. 1021 & 1022, and are as follows:

1. $1_L \longrightarrow 2_R$: Free run.
2. $2_R \longrightarrow 1_L$: o.
3. $1_L \longrightarrow 1_R$: o.
4. $1_R \longrightarrow 2_L$: $o - u$.
5. $2_L \longrightarrow 1_R$: $2u$.
6. $1_R \longrightarrow 1_L$: $o - u - 2o$.
7. $1_L \longrightarrow 2_R$: $u - 2o$.
8. $2_R \longrightarrow 1_L$: $2o - u - o$.

9. $1_L \longrightarrow 1_R$: $2u - 2o - u$.
10. $1_R \longrightarrow 2_L$: $2o - 2u$.
11. $2_L \longrightarrow 1_R$: $4u$.
12. $1_R \longrightarrow 1_L$: $2u - o - u - 4o$.
13. $1_L \longrightarrow 2_R$: $2o - u - 2o$.
14. $2_R \longrightarrow 1_L$: $2o - u - o - u - o$.

HALF-CYCLE																			
1	21	25	3	7	27	31	9	13	33	37	15	41	19	39	23	✕	21	5	25
7	27	31	9	13	33	37	15	19	39	✕	21	5	25	3	29	7	27	11	31
13	33	37	15	19	39	✕	21	25	3	7	27	11	31	9	35	13	33	17	37
19	39	✕	21	25	3	7	27	31	9	13	33	17	37	15	41	19	39	23	✕
25	3	7	27	31	9	13	33	37	15	19	39	23	✕	21	5	25	3	29	7
31	9	13	33	37	15	19	39	✕	21	25	3	29	7	27	11	31	9	35	13
37	15	19	39	✕	21	25	3	7	27	31	9	35	13	33	17	37	15	41	19
	O	O	U	U	O	O	U	U	O	O	U	U	U	O	O	O	U	U	U

HALF-CYCLE																			
5	25	3	29	7	27	11	31	9	35	13	17	37	41	19	23	✕	5	25	29
11	31	9	35	13	33	17	37	15	41	19	23	✕	5	25	29	7	11	31	35
17	37	15	41	19	39	23	✕	21	5	25	29	7	11	31	35	13	17	37	41
23	✕	21	5	25	3	29	7	27	11	31	35	13	17	37	41	19	23	✕	5
29	7	27	11	31	9	35	13	33	17	37	41	19	23	✕	5	25	29	7	11
35	13	33	17	37	15	41	19	39	23	✕	5	25	29	7	11	31	35	13	17
41	19	39	23	✕	21	5	25	3	29	7	11	31	35	13	17	37	41	19	23
	U	U	U	O	O	O	U	U	U	O	O	U	U	O	O	U	U	O	O

HALF-CYCLE																													
3	7	27	31	9	13	33	37	15	19	39	23	✕	21	5	25	3	29	7	27	11	31	35	13	17	37	41	19	23	✕
9	13	33	37	15	19	39	✕	21	25	3	29	7	27	11	31	9	35	13	33	17	37	41	19	23	✕	5	25	29	7
15	19	39	✕	21	25	3	7	27	31	9	35	13	33	17	37	15	41	19	39	23	✕	5	25	29	7	11	31	35	13
21	25	3	7	27	31	9	13	33	37	15	41	19	39	23	✕	21	5	25	3	29	7	11	31	35	13	17	37	41	19
27	31	9	13	33	37	15	19	39	✕	21	5	25	3	29	7	27	11	31	9	35	13	17	37	41	19	23	✕	5	25
33	37	15	19	39	✕	21	25	3	7	27	11	31	9	35	13	33	17	37	15	41	19	23	✕	5	25	29	7	11	31
39	✕	21	25	3	7	27	31	9	13	33	17	37	15	41	19	39	23	✕	21	5	25	29	7	11	31	35	13	17	37
	U	U	O	O	U	U	O	O	U	U	U	U	U	O	O	O	U	U	U	U	U	O	O	U	U	O	O	U	U

Fig. 1021 — Tables for the odd-numbered half-cycles.

15. $1_L \longrightarrow 1_R$: $u - o - 2u - 2o - u - o - u$.
16. $1_R \longrightarrow 2_L$: $o - u - 2o - 2u$.
17. $2_L \longrightarrow 1_R$: $6u$.
18. $1_R \longrightarrow 1_L$: $4u - o - u - 6o$.
19. $1_L \longrightarrow 2_R$: $4o - u - 2o$.
20. $2_R \longrightarrow 1_L$: $4o - u - o - u - o - u$.
21. $1_L \longrightarrow 1_R$: $u - o - u - o - 2u - o - 3u - o - u - o - u$.
22. $1_R \longrightarrow 2_L$: $o - u - o - u - 2o - 3u - o$.
23. $2_L \longrightarrow 1_R$: $2u - o - 6u - o$.
24. $1_R \longrightarrow 1_L$: $5u - 2o - 2u - 6o - u - o$.
25. $1_L \longrightarrow 2_R$: $6o - u - 3o - 2u$.

26. $2_R \longrightarrow 1_L$: $3o - u - 2o - u - o - 2u - 2o - u$.
27. $1_L \longrightarrow 1_R$: $u - o - u - o - 4u - 2o - 3u - o - u - o - 2u$.
28. $1_R \longrightarrow 2_L$: $u - o - u - o - u - 3o - 3u - 2o$.
29. $2_L \longrightarrow 1_R$: $3u - o - 4u - o - 2u - 2o$.

HALF-CYCLE																			
2	22	42	26	4	24	8	28	6	32	10	14	34	38	16	20	40	2	22	26
8	28	6	32	10	30	14	34	12	38	16	20	40	2	22	26	4	8	28	32
14	34	12	38	16	36	20	40	18	2	22	26	4	8	28	32	10	14	34	38
20	40	18	2	22	42	26	4	24	8	28	32	10	14	34	38	16	20	40	2
26	4	24	8	28	6	32	10	30	14	34	38	16	20	40	2	22	26	4	8
32	10	30	14	34	12	38	16	36	20	40	2	22	26	4	8	28	32	10	14
38	16	36	20	40	18	2	22	42	26	4	8	28	32	10	14	34	38	16	20
	O	O	O	U	U	U	O	O	O	O	U	U	O	O	U	U	O	O	U

HALF-CYCLE																			
4	24	28	6	10	30	34	12	16	36	40	18	2	22	42	26	4	24	8	28
10	30	34	12	16	36	40	18	22	42	4	24	8	28	6	32	10	30	14	34
16	36	40	18	22	42	4	24	28	6	10	30	14	34	12	38	16	36	20	40
22	42	4	24	28	6	10	30	34	12	16	36	20	40	18	2	22	42	26	4
28	6	10	30	34	12	16	36	40	18	22	42	26	4	24	8	28	6	32	10
34	12	16	36	40	18	22	42	4	24	28	6	32	10	30	14	34	12	38	16
40	18	22	42	4	24	28	6	10	30	34	12	38	16	36	20	40	18	2	22
	U	O	O	U	U	O	O	U	U	O	O	O	O	U	U	U	O	O	O

HALF-CYCLE																													
6	10	30	34	12	16	36	40	18	22	42	26	4	24	8	28	6	32	10	30	14	34	38	16	20	40	2	22	26	4
12	16	36	40	18	22	42	4	24	28	6	32	10	30	14	34	12	38	16	36	20	40	2	22	26	4	8	28	32	10
18	22	42	4	24	28	6	10	30	34	12	38	16	36	20	40	18	2	22	42	26	4	8	28	32	10	14	34	38	16
24	28	6	10	30	34	12	16	36	40	18	2	22	42	26	4	24	8	28	6	32	10	14	34	38	16	20	40	2	22
30	34	12	16	36	40	18	22	42	4	24	8	28	6	32	10	30	14	34	12	38	16	20	40	2	22	26	4	8	28
36	40	18	22	42	4	24	28	6	10	30	14	34	12	38	16	36	20	40	18	2	22	26	4	8	28	32	10	14	34
42	4	24	28	6	10	30	34	12	16	36	20	40	18	2	22	42	26	4	24	8	28	32	10	14	34	38	16	20	40
	O	U	U	O	O	U	U	O	O	U	O	O	O	U	U	U	O	O	O	U	O	O	U	U	O	O	U	U	O

Fig. 1022 — Tables for the even-numbered half-cycles.

30. $1_R \longrightarrow 1_L$: $4u - o - u - 3o - 2u - 4o - u - 2o - 2u - o$.
31. $1_L \longrightarrow 2_R$: $6o - 3u - 3o - 2u$.
32. $2_R \longrightarrow 1_L$: $3o - u - 2o - 2u - 2o - 2u - 2o - u$.
33. $1_L \longrightarrow 1_R$: $u - o - u - 2o - 5u - 2o - 3u - o - 2u - 2o - 2u$.
34. $1_R \longrightarrow 2_L$: $u - o - u - o - 2u - 4o - 3u - 2o$.
35. $2_L \longrightarrow 1_R$: $3u - o - 2u - o - 2u - 2o - 2u - 2o$.
36. $1_R \longrightarrow 1_L$: $2u - o - 2u - 2o - u - 3o - 2u - 2o - u - 2o - 2u - 2o - 2u - o$.
37. $1_L \longrightarrow 2_R$: $4o - 2u - 2o - 3u - 3o - 2u$.
38. $2_R \longrightarrow 1_L$: $3o - 2u - 2o - 3u - 2o - 2u - 2o - u$.
39. $1_L \longrightarrow 1_R$: $u - 2o - 2u - 2o - 5u - 2o - 4u - 2o - 2u - 2o - 2u$.
40. $1_R \longrightarrow 2_L$: $u - o - 2u - 2o - 2u - 4o - 3u - 3o$.

41. $2_L \longrightarrow 1_R : \; 3u - 2o - 3u - 2o - 2u - 2o - 2u - 2o\,.$

42. $1_R \longrightarrow 1_L : \; o - 2u - 2o - 2u - 2o - u - 3o - 3u - 3o - u - 2o - 2u - 2o - 2u - o\,.$

Euclid's algorithm, the path formula, the path in the RKT for the interbraided Regular Knots and their algorithm diagrams are shown in Fig. 1020. Hence the half-cycle braiding algorithms for the interbraided Regular Knots between the bight-boundaries 1_L and 2_L, respectively between the bight-boundaries 1_R and 2_R, are identical to those on pg. 1286.

Example 3.

Let in Fig. 1009 $C_1 = 15$, $C_2 = 13$, $C_3 = 15$, then for a component with such a first-return string-run $\beta = 4C_1 + 3C_2 = 4C_3 + 3C_2 = 99$ while $\alpha = 3$. Note that C_1, C_2 and C_3 must be chosen so that β is divisible by $\alpha = 3$. Let $B_c = 21$. Note that B_c must be chosen so that B_c is divisible by $\alpha = 3$.

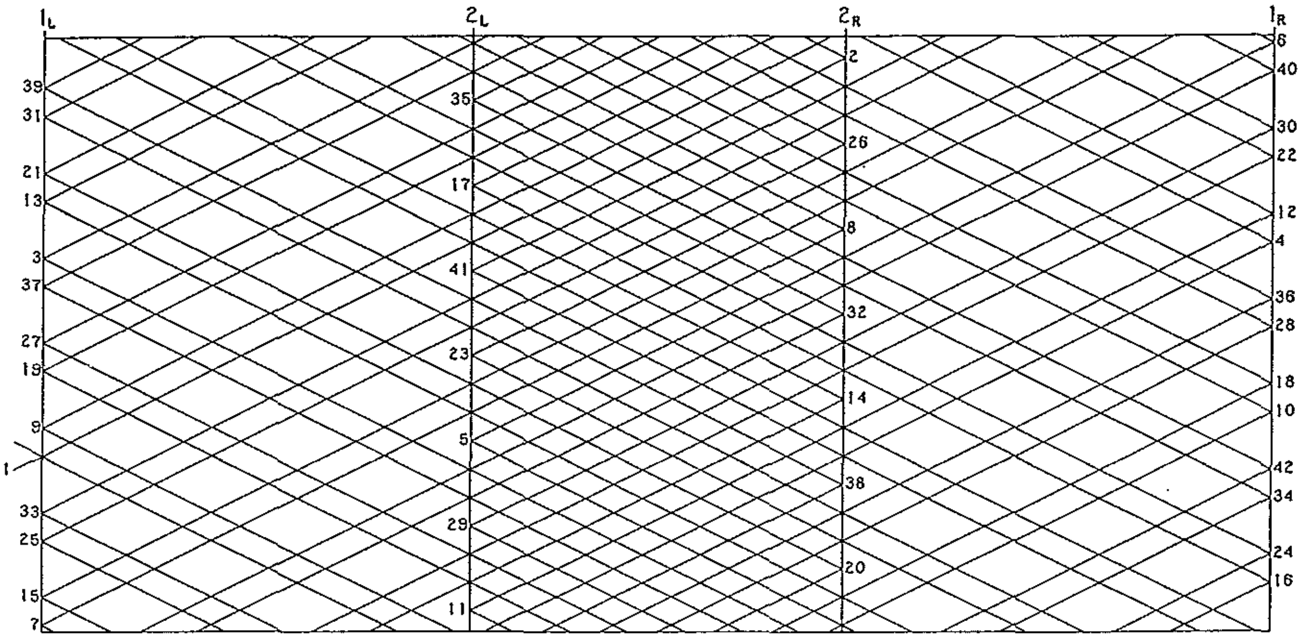

Fig. 1023 — The string-run of the foundation braid.

Thus for this component we obtain:

$$\lambda = \text{g.c.d.}\left(\frac{\beta}{\alpha}\,,\,\frac{B_c}{\alpha}\right) = \text{g.c.d.}\left(\frac{99}{3}\,,\,\frac{21}{3}\right) = \text{g.c.d.}\,(33\,,\,7) = 1\,,$$

and hence only one essential string is required.

The string-run of this component consist of $\left(\frac{B_c}{\alpha}\right) = \left(\frac{21}{3}\right) = 7$ consecutive first-return string-runs.

The diagram in Fig. 1023 depicts the string-run of the foundation braid.

This foundation braid can be interbraided with two Regular Cylindrical Braids, one between the two leftmost bight-boundaries 1_L and 2_L and one between the two rightmost bight-boundaries 1_R and 2_R. For each of these two Regular Cylindrical Braids $p = 5$ and $b = 7$. Hence each braid is a Regular Knot and thus requires only one essential string.

Fig. 1024 depicts the string-runs of the two interbraided Regular Knots.

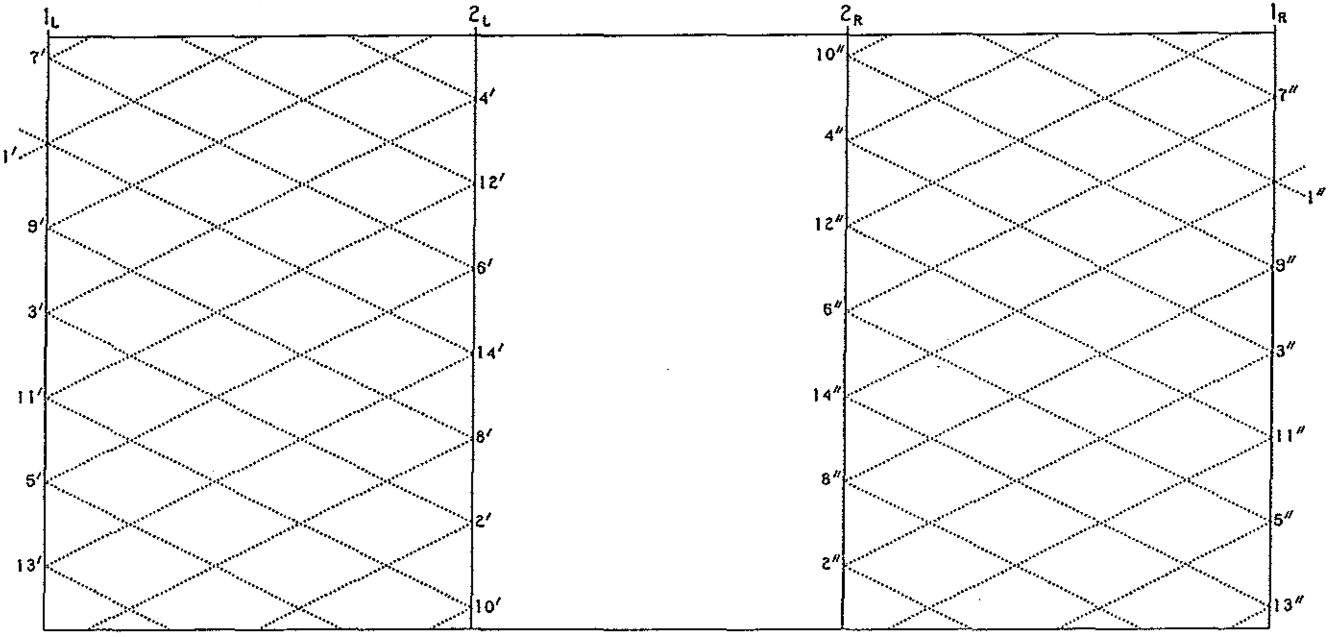

Fig. 1024 — The string-runs of the two interbraided Regular Knots.

A superimposed coding on the three string-runs is shown in Fig. 1025.

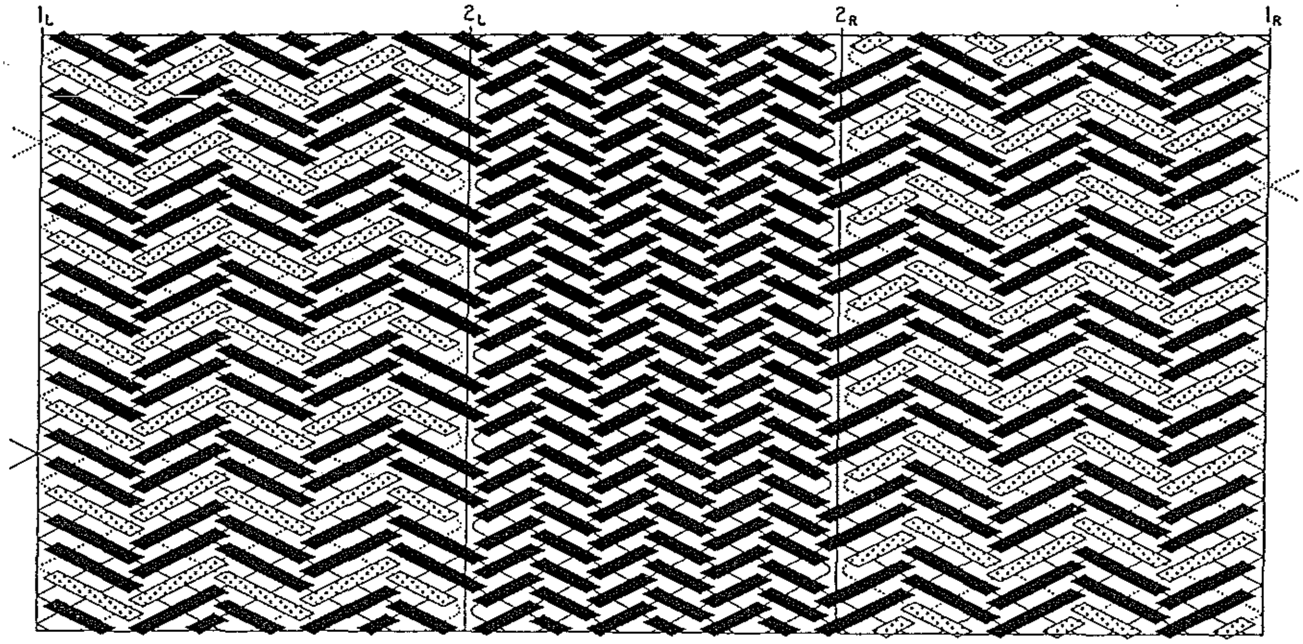

Fig. 1025 — A coding superimposed on the string-runs.

The half-cycle braiding algorithms for the foundation knot can be read from the tables in Figs. 1026 & 1027.

1. $1_L \longrightarrow 2_R$: Free run.
2. $2_R \longrightarrow 1_L$: o.
3. $1_L \longrightarrow 1_R$: o.
4. $1_R \longrightarrow 2_L$: o.
5. $2_L \longrightarrow 1_R$: o.
6. $1_R \longrightarrow 1_L$: $u - 3o$.

7. $1_L \longrightarrow 2_R$: $u - o$.
8. $2_R \longrightarrow 1_L$: $4o$.
9. $1_L \longrightarrow 1_R$: $o - u - o - u - 2o$.
10. $1_R \longrightarrow 2_L$: $o - u - 2o - u$.
11. $2_L \longrightarrow 1_R$: $5o$.
12. $1_R \longrightarrow 1_L$: $o - u - 2o - u - 4o$.
13. $1_L \longrightarrow 2_R$: $o - 2u - 2o - u$.
14. $2_R \longrightarrow 1_L$: $2o - u - 4o$.

HALF-CYCLE																						
1	9	19	27	37	3	13	21	31	39	7	15	17	25	33	35	X	9	11	19	27	29	37
7	15	25	33	X	9	19	27	37	3	13	21	23	31	39	41	7	15	17	25	33	35	X
13	21	31	39	7	15	25	33	X	9	19	27	29	37	3	5	13	21	23	31	39	41	7
19	27	37	3	13	21	31	39	7	15	25	33	35	X	9	11	19	27	29	37	3	5	13
25	33	X	9	19	27	37	3	13	21	31	39	41	7	15	17	25	33	35	X	9	11	19
31	39	7	15	25	33	X	9	19	27	37	3	5	13	21	23	31	39	41	7	15	17	25
37	3	13	21	31	39	7	15	25	33	X	9	11	19	27	29	37	3	5	13	21	23	31
	U	U	O	O	U	U	O	O	U	U	O	O	U	U	O	O	U	U	O	O	U	U

HALF-CYCLE																						
5	13	21	23	31	39	41	7	15	17	25	33	35	X	11	19	29	37	5	13	23	31	41
11	19	27	29	37	3	5	13	21	23	31	39	41	7	17	25	35	X	11	19	29	37	5
17	25	33	35	X	9	11	19	27	29	37	3	5	13	23	31	41	7	17	25	35	X	11
23	31	39	41	7	15	17	25	33	35	X	9	11	19	29	37	5	13	23	31	41	7	17
29	37	3	5	13	21	23	31	39	41	7	15	17	25	35	X	11	19	29	37	5	13	23
35	X	9	11	19	27	29	37	3	5	13	21	23	31	41	7	17	25	35	X	11	19	29
41	7	15	17	25	33	35	X	9	11	19	27	29	37	5	13	23	31	41	7	17	25	35
	O	O	U	U	O	O	U	U	O	O	U	U	O	O	U	U	O	O	U	U	O	O

HALF-CYCLE																																
3	13	21	31	39	7	15	25	33	X	9	11	19	27	29	37	3	5	13	21	23	31	39	41	7	17	25	35	X	11	19	29	37
9	19	27	37	3	13	21	31	39	7	15	17	25	33	35	X	9	11	19	27	29	37	3	5	13	23	31	41	7	17	25	35	X
15	25	33	X	9	19	27	37	3	13	21	23	31	39	41	7	15	17	25	33	35	X	9	11	19	29	37	5	13	23	31	41	7
21	31	39	7	15	25	33	X	9	19	27	29	37	3	5	13	21	23	31	39	41	7	15	17	25	35	X	11	19	29	37	5	13
27	37	3	13	21	31	39	7	15	25	33	35	X	9	11	19	27	29	37	3	5	13	21	23	31	41	7	17	25	35	X	11	19
33	X	9	19	27	37	3	13	21	31	39	41	7	15	17	25	33	35	X	9	11	19	27	29	37	5	13	23	31	41	7	17	25
39	7	15	25	33	X	9	19	27	37	3	5	13	21	23	31	39	41	7	15	17	25	33	35	X	11	19	29	37	5	13	23	31
	U	U	O	O	U	U	O	O	U	U	O	O	U	U	O	O	U	U	O	O	U	U	O	O	U	U	O	O	U	U	O	O

Fig. 1026 — Tables for the odd-numbered half-cycles.

15. $1_L \longrightarrow 1_R$: $2o - u - 2o - u - 4o$.
16. $1_R \longrightarrow 2_L$: $2o - 2u - 2o - 2u$.
17. $2_L \longrightarrow 1_R$: $2o - 2u - 4o$.
18. $1_R \longrightarrow 1_L$: $3o - 2u - 2o - 2u - 5o$.
19. $1_L \longrightarrow 2_R$: $3o - 2u - 3o - 2u$.
20. $2_R \longrightarrow 1_L$: $u - 2o - 2u - o - u - 4o$.
21. $1_L \longrightarrow 1_R$: $3o - 3u - 2o - 2u - 5o$.
22. $1_R \longrightarrow 2_L$: $3o - 3u - 3o - 2u$.
23. $2_L \longrightarrow 1_R$: $u - 2o - 2u - o - u - 4o$.
24. $1_R \longrightarrow 1_L$: $4o - 3u - 3o - 2u - o - u - 4o$.
25. $1_L \longrightarrow 2_R$: $4o - 3u - 3o - 2u$.
26. $2_R \longrightarrow 1_L$: $2u - 3o - 2u - o - u - 2o - u - 2o$.

27. $1_L \longrightarrow 1_R$: $u - 4o - 3u - 4o - 2u - o - u - 4o$.
28. $1_R \longrightarrow 2_L$: $u - 4o - u - o - 2u - 4o - 2u$.
29. $2_L \longrightarrow 1_R$: $o - 2u - 3o - 2u - o - u - 2o - u - 2o$.
30. $1_R \longrightarrow 1_L$: $u - 4o - u - o - 2u - 4o - 2u - o - 2u - 2o - u - 2o$.
31. $1_L \longrightarrow 2_R$: $u - 4o - u - 2o - 2u - 4o - 2u$.
32. $2_R \longrightarrow 1_L$: $o - 2u - 4o - 2u - o - 2u - 2o - u - 2o$.
33. $1_L \longrightarrow 1_R$: $u - 2o - u - 2o - u - o - 2u - 4o - 2u - o - 2u - 2o - u - 2o$.
34. $1_R \longrightarrow 2_L$: $u - 2o - u - 2o - u - 2o - 2u - 2o - u - 2o - 2u$.

HALF-CYCLE																						
2	10	18	20	28	36	38	4	12	14	22	30	32	40	8	16	26	34	2	10	20	28	38
8	16	24	26	34	42	2	10	18	20	28	36	38	4	14	22	32	40	8	16	26	34	2
14	22	30	32	40	6	8	16	24	26	34	42	2	10	20	28	38	4	14	22	32	40	8
20	28	36	38	4	12	14	22	30	32	40	6	8	16	26	34	2	10	20	28	38	4	14
26	34	42	2	10	18	20	28	36	38	4	12	14	22	32	40	8	16	26	34	2	10	20
32	40	6	8	16	24	26	34	42	2	10	18	20	28	38	4	14	22	32	40	8	16	26
38	4	12	14	22	30	32	40	6	8	16	24	26	34	2	10	20	28	38	4	14	22	32
	O	O	U	U	O	O	U	U	O	O	U	U	O	O	U	U	O	O	U	U	O	O

HALF-CYCLE																						
4	12	22	30	40	6	16	24	34	42	10	18	20	28	36	38	4	12	14	22	30	32	40
10	18	28	36	4	12	22	30	40	6	16	24	26	34	42	2	10	18	20	28	36	38	4
16	24	34	42	10	18	28	36	4	12	22	30	32	40	6	8	16	24	26	34	42	2	10
22	30	40	6	16	24	34	42	10	18	28	36	38	4	12	14	22	30	32	40	6	8	16
28	36	4	12	22	30	40	6	16	24	34	42	2	10	18	20	28	36	38	4	12	14	22
34	42	10	18	28	36	4	12	22	30	40	6	8	16	24	26	34	42	2	10	18	20	28
40	6	16	24	34	42	10	18	28	36	4	12	14	22	30	32	40	6	8	16	24	26	34
	U	U	O	O	U	U	O	O	U	U	O	O	U	U	O	O	U	U	O	O	U	U

HALF-CYCLE																																
6	16	24	34	42	10	18	28	36	4	12	14	22	30	32	40	6	8	16	24	26	34	42	2	10	20	28	38	4	14	22	32	40
12	22	30	40	6	16	24	34	42	10	18	20	28	36	38	4	12	14	22	30	32	40	6	8	16	26	34	2	10	20	28	38	4
18	28	36	4	12	22	30	40	6	16	24	26	34	42	2	10	18	20	28	36	38	4	12	14	22	32	40	8	16	26	34	2	10
24	34	42	10	18	28	36	4	12	22	30	32	40	6	8	16	24	26	34	42	2	10	18	20	28	38	4	14	22	32	40	8	16
30	40	6	16	24	34	42	10	18	28	36	38	4	12	14	22	30	32	40	6	8	16	24	26	34	2	10	20	28	38	4	14	22
36	4	12	22	30	40	6	16	24	34	42	2	10	18	20	28	36	38	4	12	14	22	30	32	40	8	16	26	34	2	10	20	28
42	10	18	28	36	4	12	22	30	40	6	8	16	24	26	34	42	2	10	18	20	28	36	38	4	14	22	32	40	8	16	26	34
	U	U	O	O	U	U	O	O	U	U	O	O	U	U	O	O	U	U	O	O	U	U	O	O	U	U	O	O	U	U	O	O

Fig. 1027 — Tables for the even-numbered half-cycles.

35. $2_L \longrightarrow 1_R$: $o - 2u - 2o - u - 2o - 2u - o - 2u - 2o - u - 2o$.
36. $1_R \longrightarrow 1_L$: $2u - 2o - u - 2o - u - 2o - 2u - 2o - u - 2o - 2u - 2o - 2u - 2o - 2u - 2o$.
37. $1_L \longrightarrow 2_R$: $2u - 2o - u - 2o - u - 2o - 2u - 2o - 2u - 2o - 2u$.
38. $2_R \longrightarrow 1_L$: $2o - 2u - 2o - u - 2o - 2u - 2o - 2u - 2o - 2u - 2o$.
39. $1_L \longrightarrow 1_R$: $2u - 2o - u - 2o - 2u - 2o - 2u - 2o - u - 2o - 2u - o - 2u - 2o - 2u - 2o$.
40. $1_R \longrightarrow 2_L$: $2u - 2o - u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - 2u$.
41. $2_L \longrightarrow 1_R$: $2o - 2u - 2o - u - 2o - 2u - 2o - 2u - 2o - 2u - 2o$.
42. $1_R \longrightarrow 1_L$: $2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o$.

Euclid's algorithm, the path formula, the path in the RKT for the interbraided Regular Knots and their algorithm diagrams are shown in Fig. 1028.

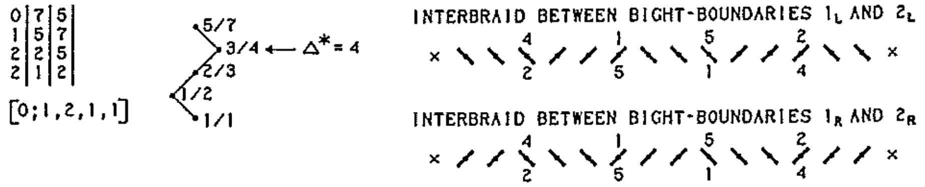
0 7 5
1 5 7
2 2 5
2 1 2
[0;1,2,1,1]
5/7
3/4
Δ* = 4
2/3
1/2
1/1
INTERBRAID BETWEEN BIGHT-BOUNDARIES 1L AND 2L
4 1 5 2
2 5 1 4
INTERBRAID BETWEEN BIGHT-BOUNDARIES 1R AND 2R
4 1 5 2
2 5 1 4

Fig. 1028 — Euclid's algorithm, path formula, path in RKT and algorithm diagrams for interbraided Regular Knots.

For the interbraided Regular Knot between the bight-boundaries 1_L and 2_L, the algorithm diagram is identical to the upper algorithm diagram in Fig. 1015, pg. 1282 and hence the half-cycle braiding algorithms for the interbraided Regular Knot between the bight-boundaries 1_L and 2_L are identical to the ones on pg. 1282.

The half-cycle braiding algorithms for the half-cycles $1''$-$14''$ of the interbraided Regular Knot between the bight-boundaries 1_R and 2_R are identical to the braiding algorithms for the half-cycles $1'$-$14'$ of the interbraided Regular Knot between the bight-boundaries 1_L and 2_L.

Example 4.

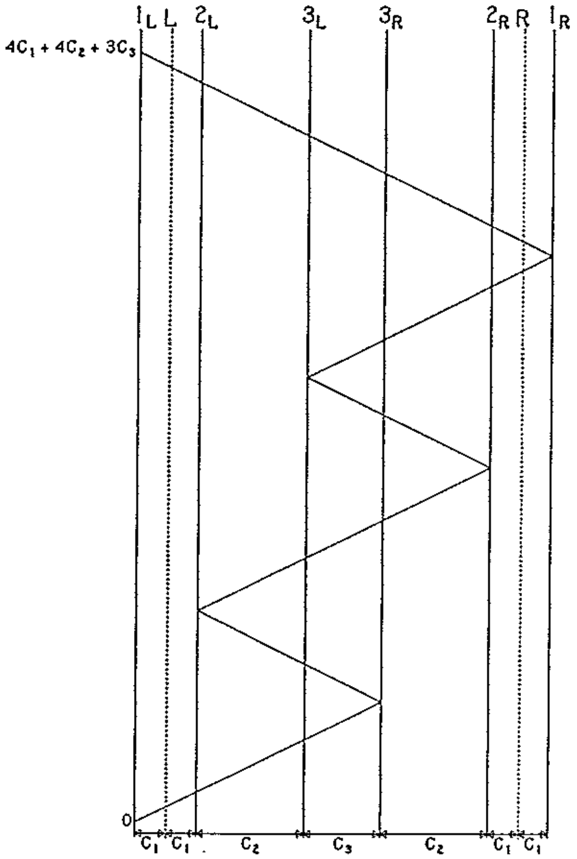

Fig. 1029 — The first-return string-run of a component in a cylindrical braid.

Let in Fig. 1029 $C_1 = 2$, $C_2 = 19$, $C_3 = 9$, then for a component with such a first-return string-run $\beta = 4C_1 + 4C_2 + 3C_3 = 4 \times 2 + 4 \times 19 + 3 \times 9 = 8 + 76 + 27 = 111$ while

$\alpha = 3$. Note that C_1, C_2 and C_3 must be chosen so that β is divisible by $\alpha = 3$. Let $B_c = 27$. Note that B_c must be chosen so that B_c is divisible by $\alpha = 3$.

Thus for this component we obtain:

$$\lambda = \text{g.c.d.}\left(\frac{\beta}{\alpha}, \frac{B_c}{\alpha}\right) = \text{g.c.d.}\left(\frac{111}{3}, \frac{27}{3}\right) = \text{g.c.d.}\ (37, 9) = 1,$$

and hence only one essential string is required.

The string-run of this component consist of $\left(\frac{B_c}{\alpha}\right) = \left(\frac{27}{3}\right) = 9$ consecutive first-return string-runs.

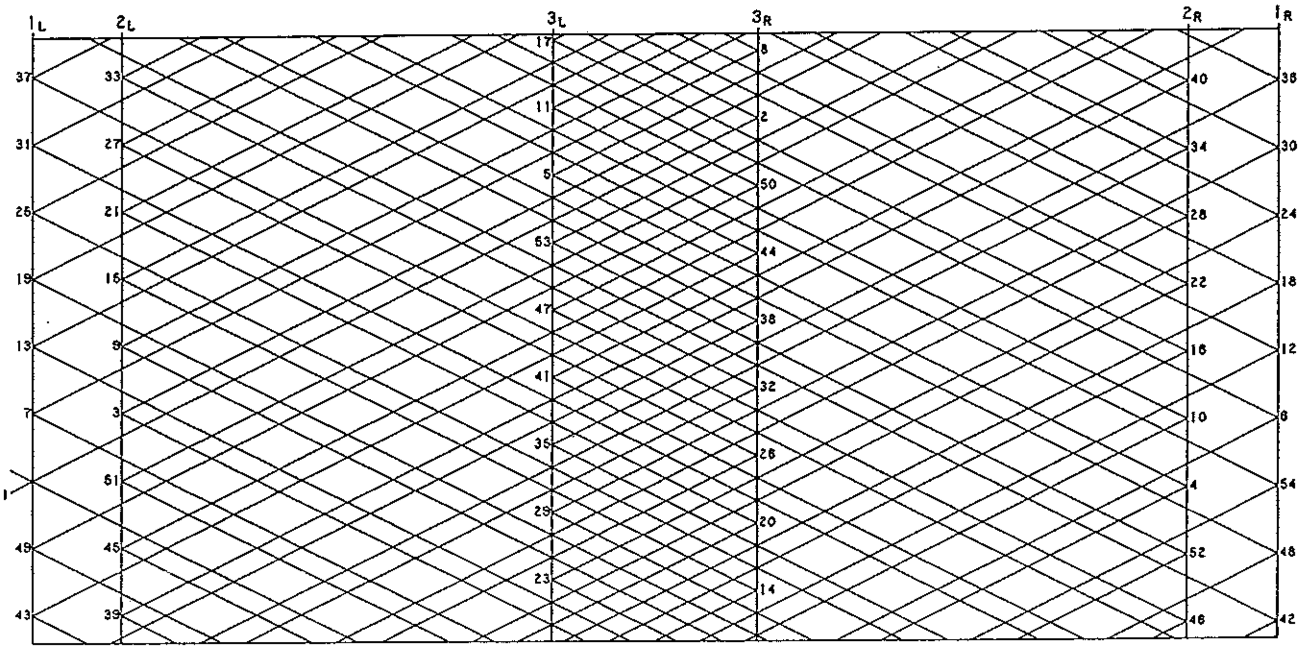

Fig. 1030 — The string-run of the foundation braid.

This foundation braid can be interbraided with two Regular Cylindrical Braids, one between bight-boundaries L and 3_L and one between bight-boundaries R and 3_R.

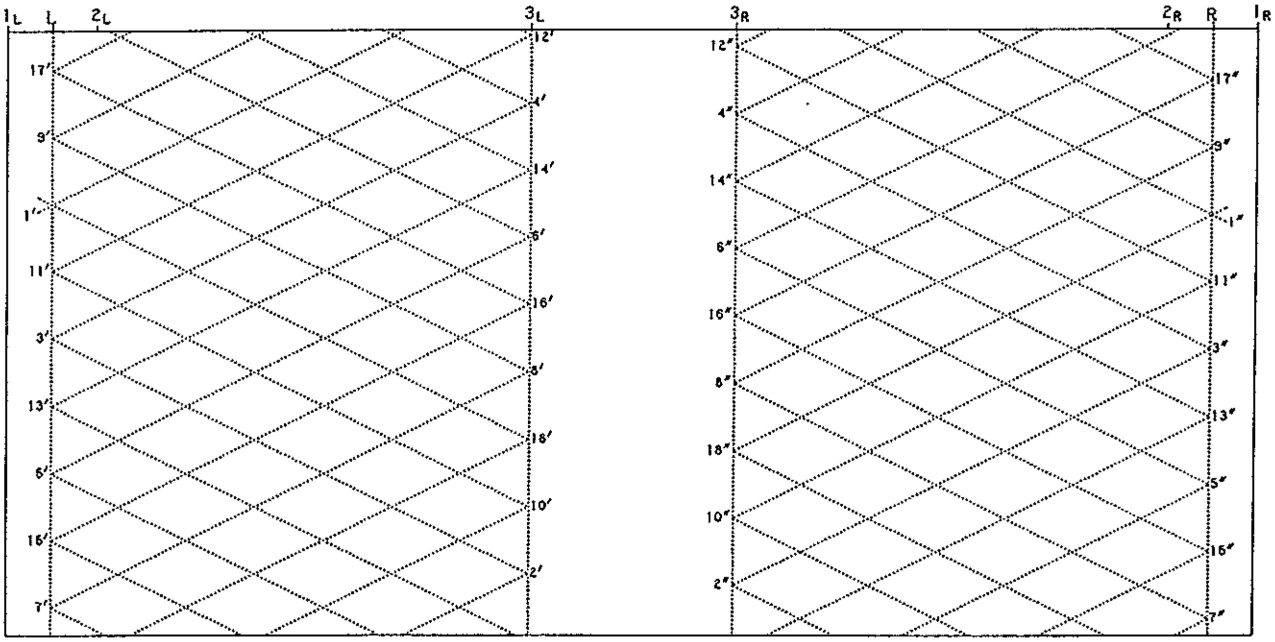

Fig. 1031 — The string-runs of the two interbraided Regular Knots.

Fig. 1030 depicts the string-run diagram of the foundation braid and in Fig. 1031 are depicted the string-runs of the two interbraided Regular Knots.

For each of these two Regular Cylindrical Braids $p = 7$ and $b = 9$. Hence each braid is a Regular Knot and thus requires only one essential string.

A superimposed coding on the three string-runs is shown in Fig. 1032.

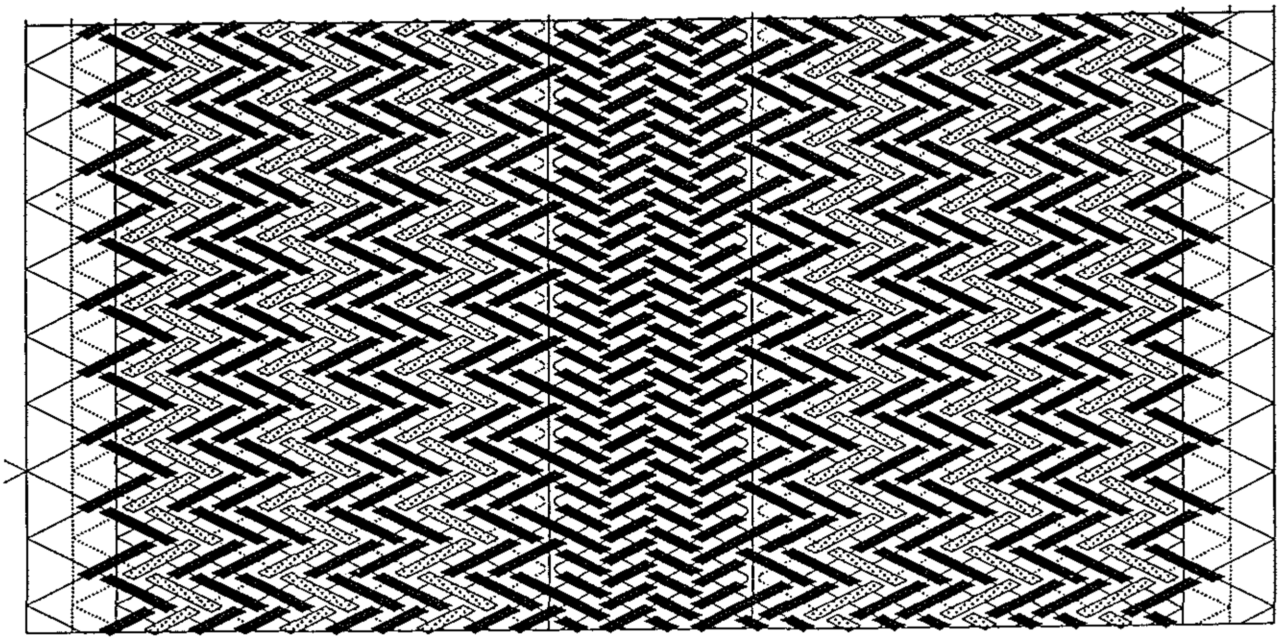

Fig. 1032 — A coding superimposed on the string-runs.

The half-cycle braiding algorithms for the foundation knot can be read from the tables in Figs. 1033 & 1034.

1. $1_L \longrightarrow 3_R$: Free run.
2. $3_R \longrightarrow 2_L$: u.
3. $2_L \longrightarrow 2_R$: o.
4. $2_R \longrightarrow 3_L$: $2o$.
5. $3_L \longrightarrow 1_R$: $2o$.
6. $1_R \longrightarrow 1_L$: $u - 2o - u$.
7. $1_L \longrightarrow 3_R$: $o - u$.
8. $3_R \longrightarrow 2_L$: $o - 2u$.
9. $2_L \longrightarrow 2_R$: $o - u - o - u$.
10. $2_R \longrightarrow 3_L$: $o - 2u - 2o$.
11. $3_L \longrightarrow 1_R$: $u - 2o - u - o - u$.
12. $1_R \longrightarrow 1_L$: $o - 2u - 4o - u$.
13. $1_L \longrightarrow 3_R$: $u - 2o - u$.
14. $3_R \longrightarrow 2_L$: $u - 2o - 2u$.
15. $2_L \longrightarrow 2_R$: $2u - o - u - 2o - 2u$.
16. $2_R \longrightarrow 3_L$: $2u - 2o - 2u - 2o$.
17. $3_L \longrightarrow 1_R$: $2u - 3o - u - 2o - u$.
18. $1_R \longrightarrow 1_L$: $u - 2o - 2u - 2o - 2u - 2o - u$.
19. $1_L \longrightarrow 3_R$: $2o - u - 2o - u$.
20. $3_R \longrightarrow 2_L$: $o - 2u - 2o - 2u$.
21. $2_L \longrightarrow 2_R$: $o - 3u - o - u - o - u - 2o - 2u$.
22. $2_R \longrightarrow 3_L$: $4u - 2o - 2u - 2o$.
23. $3_L \longrightarrow 1_R$: $2u - 2o - u - o - 2u - 2o - u$.

24. $1_R \longrightarrow 1_L$: $o - 2u - 2o - 2u - 4o - 2u - 2o - u\,.$
25. $1_L \longrightarrow 3_R$: $2u - 2o - u - 2o - u\,.$
26. $3_R \longrightarrow 2_L$: $u - 2o - 2u - 2o - 2u\,.$
27. $2_L \longrightarrow 2_R$: $u - 2o - 3u - o - u - 2o - 2u - 2o - 2u\,.$
28. $2_R \longrightarrow 3_L$: $2o - 4u - 2o - 2u - 2o\,.$
29. $3_L \longrightarrow 1_R$: $2u - 3o - u - 2o - 2u - 2o - u\,.$

HALF-CYCLE																						
1	7	3	13	9	19	15	25	21	31	27	37	33	43	39	49	5	45	╳	11	51	7	17
7	13	9	19	15	25	21	31	27	37	33	43	39	49	45	╳	11	51	7	17	3	13	23
13	19	15	25	21	31	27	37	33	43	39	49	45	╳	51	7	17	3	13	23	9	19	29
19	25	21	31	27	37	33	43	39	49	45	╳	51	7	3	13	23	9	19	29	15	25	35
25	31	27	37	33	43	39	49	45	╳	51	7	3	13	9	19	29	15	25	35	21	31	41
31	37	33	43	39	49	45	╳	51	7	3	13	9	19	15	25	35	21	31	41	27	37	47
37	43	39	49	45	╳	51	7	3	13	9	19	15	25	21	31	41	27	37	47	33	43	53
43	49	45	╳	51	7	3	13	9	19	15	25	21	31	27	37	47	33	43	53	39	49	5
49	╳	51	7	3	13	9	19	15	25	21	31	27	37	33	43	53	39	49	5	45	╳	11
	O	O	U	U	O	O	U	U	O	O	U	U	O	O	U	U	O	O	U	U	O	O

HALF-CYCLE																						
5	45	╳	11	51	7	17	3	13	23	19	29	25	35	31	41	37	47	43	53	49	5	╳
11	51	7	17	3	13	23	9	19	29	25	35	31	41	37	47	43	53	49	5	╳	11	7
17	3	13	23	9	19	29	15	25	35	31	41	37	47	43	53	49	5	╳	11	7	17	13
23	9	19	29	15	25	35	21	31	41	37	47	43	53	49	5	╳	11	7	17	13	23	19
29	15	25	35	21	31	41	27	37	47	43	53	49	5	╳	11	7	17	13	23	19	29	25
35	21	31	41	27	37	47	33	43	53	49	5	╳	11	7	17	13	23	19	29	25	35	31
41	27	37	47	33	43	53	39	49	5	╳	11	7	17	13	23	19	29	25	35	31	41	37
47	33	43	53	39	49	5	45	╳	11	7	17	13	23	19	29	25	35	31	41	37	47	43
53	39	49	5	45	╳	11	51	7	17	13	23	19	29	25	35	31	41	37	47	43	53	49
	U	U	O	O	U	U	O	O	O	U	U	O	O	U	U	O	O	U	U	O	O	U

HALF-CYCLE																																		
3	13	9	19	15	25	21	31	27	37	33	43	39	49	5	45	╳	11	51	7	17	3	13	23	19	29	25	35	31	41	37	47	43	53	49
9	19	15	25	21	31	27	37	33	43	39	49	45	╳	11	51	7	17	3	13	23	9	19	29	25	35	31	41	37	47	43	53	49	5	╳
15	25	21	31	27	37	33	43	39	49	45	╳	51	7	17	3	13	23	9	19	29	15	25	35	31	41	37	47	43	53	49	5	╳	11	7
21	31	27	37	33	43	39	49	45	╳	51	7	3	13	23	9	19	29	15	25	35	21	31	41	37	47	43	53	49	5	╳	11	7	17	13
27	37	33	43	39	49	45	╳	51	7	3	13	9	19	29	15	25	35	21	31	41	27	37	47	43	53	49	5	╳	11	7	17	13	23	19
33	43	39	49	45	╳	51	7	3	13	9	19	15	25	35	21	31	41	27	37	47	33	43	53	49	5	╳	11	7	17	13	23	19	29	25
39	49	45	╳	51	7	3	13	9	19	15	25	21	31	41	27	37	47	33	43	53	39	49	5	╳	11	7	17	13	23	19	29	25	35	31
45	╳	51	7	3	13	9	19	15	25	21	31	27	37	47	33	43	53	39	49	5	45	╳	11	7	17	13	23	19	29	25	35	31	41	37
51	7	3	13	9	19	15	25	21	31	27	37	33	43	53	39	49	5	45	╳	11	51	7	17	13	23	19	29	25	35	31	41	37	47	43
	U	O	O	U	U	O	O	U	U	O	O	U	U	U	U	O	O	U	U	O	O	U	O	O	U	U	O	O	U	U	O	O	U	U

Fig. 1033 — Tables for the odd-numbered half-cycles.

30. $1_R \longrightarrow 1_L$: $u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - u\,.$
31. $1_L \longrightarrow 3_R$: $2o - 2u - 2o - u - 2o - u\,.$
32. $3_R \longrightarrow 2_L$: $o - 2u - 2o - 2u - 2o - 2u\,.$
33. $2_L \longrightarrow 2_R$: $o - 2u - 2o - 3u - o - u - o - u - 2o - 2u - 2o - 2u\,.$
34. $2_R \longrightarrow 3_L$: $2u - 2o - 4u - 2o - 2u - 2o\,.$
35. $3_L \longrightarrow 1_R$: $2u - 2o - u - o - 2u - 2o - 2u - 2o - u\,.$
36. $1_R \longrightarrow 1_L$: $o - 2u - 2o - 2u - 2o - 2u - 4o - 2u - 2o - 2u - 2o - u\,.$
37. $1_L \longrightarrow 3_R$: $2u - 2o - 2u - 2o - u - 2o - u\,.$
38. $3_R \longrightarrow 2_L$: $u - 2o - 2u - 2o - 2u - 2o - 2u\,.$
39. $2_L \longrightarrow 2_R$: $u - 2o - 2u - 2o - 3u - o - u - 2o - 2u - 2o - 2u - 2o - 2u\,.$

40. $2_R \longrightarrow 3_L$: $2o - 2u - 2o - 4u - 2o - 2u - 2o$.
41. $3_L \longrightarrow 1_R$: $2u - 2o - u - 2o - 2u - 2o - 2u - 2o - u$.
42. $1_R \longrightarrow 1_L$: $u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - u$.
43. $1_L \longrightarrow 3_R$: $2o - 2u - 2o - 2u - 2o - u - 2o - u - o$.
44. $3_R \longrightarrow 2_L$: $u - 2o - u - 2o - 2u - 2o - 2u - 2o - 2u$.

HALF-CYCLE																					
2	4	6	8	10	12	14	16	18	20	22	26	28	32	34	38	40	44	46	50	52	2
8	10	12	14	16	18	20	22	24	26	28	32	34	38	40	44	46	50	52	2	4	8
14	16	18	20	22	24	26	28	30	32	34	38	40	44	46	50	52	2	4	8	10	14
20	22	24	26	28	30	32	34	36	38	40	44	46	50	52	2	4	8	10	14	16	20
26	28	30	32	34	36	38	40	42	44	46	50	52	2	4	8	10	14	16	20	22	26
32	34	36	38	40	42	44	46	48	50	52	2	4	8	10	14	16	20	22	26	28	32
38	40	42	44	46	48	50	52	54	2	4	8	10	14	16	20	22	26	28	32	34	38
44	46	48	50	52	54	2	4	6	8	10	14	16	20	22	26	28	32	34	38	40	44
50	52	54	2	4	6	8	10	12	14	16	20	22	26	28	32	34	38	40	44	46	50
	U	U	0	0	U	U	0	0	U	0	0	U	U	0	0	U	U	0	0	U	U

HALF-CYCLE																					
4	6	10	12	16	18	22	24	28	30	34	36	40	42	44	46	48	50	52	54	2	4
10	12	16	18	22	24	28	30	34	36	40	42	46	48	50	52	54	2	4	6	8	10
16	18	22	24	28	30	34	36	40	42	46	48	52	54	2	4	6	8	10	12	14	16
22	24	28	30	34	36	40	42	46	48	52	54	4	6	8	10	12	14	16	18	20	22
28	30	34	36	40	42	46	48	52	54	4	6	10	12	14	16	18	20	22	24	26	28
34	36	40	42	46	48	52	54	4	6	10	12	16	18	20	22	24	26	28	30	32	34
40	42	46	48	52	54	4	6	10	12	16	18	22	24	26	28	30	32	34	36	38	40
46	48	52	54	4	6	10	12	16	18	22	24	28	30	32	34	36	38	40	42	44	46
52	54	4	6	10	12	16	18	22	24	28	30	34	36	38	40	42	44	46	48	50	52
	U	0	0	U	U	0	0	U	U	0	0	U	U	U	U	0	0	U	U	0	0

HALF-CYCLE																																				
6	12	18	18	22	24	28	30	34	36	40	42	46	48	52	54	2	4	6	8	10	12	14	16	20	22	26	28	32	34	38	40	44	46	50	52	2
12	18	22	24	28	30	34	36	40	42	46	48	52	54	4	6	8	10	12	14	18	18	20	22	26	28	32	34	38	40	44	46	50	52	2	4	8
18	24	28	30	34	36	40	42	46	48	52	54	4	6	10	12	14	16	18	20	22	24	26	28	32	34	38	40	44	46	50	52	2	4	8	10	14
24	30	34	36	40	42	46	48	52	54	4	6	10	12	16	18	20	22	24	26	28	30	32	34	38	40	44	46	50	52	2	4	8	10	14	16	20
30	36	40	42	46	48	52	54	4	6	10	12	16	18	22	24	26	28	30	32	34	36	38	40	44	46	50	52	2	4	8	10	14	16	20	22	26
36	42	46	48	52	54	4	6	10	12	18	18	22	24	28	30	32	34	36	38	40	42	44	46	50	52	2	4	8	10	14	16	20	22	26	28	32
42	48	52	54	4	6	10	12	16	18	22	24	28	30	34	36	38	40	42	44	46	48	50	52	2	4	8	10	14	16	20	22	26	28	32	34	38
48	54	4	6	10	12	16	18	22	24	28	30	34	36	40	42	44	46	48	50	52	54	2	4	8	10	14	16	20	22	26	28	32	34	38	40	44
54	6	10	12	16	18	22	24	28	30	34	36	40	42	46	48	50	52	54	2	4	6	8	10	14	16	20	22	26	28	32	34	38	40	44	46	50
	0	0	U	U	0	0	U	U	0	0	U	U	0	0	U	U	0	0	U	U	0	0	0	U	U	0	0	U	U	0	0	U	U	0	0	U

Fig. 1034 — Tables for the even-numbered half-cycles.

45. $2_L \longrightarrow 2_R$: $o - 2u - 2o - 2u - 2o - 3u - o - u - 4o - 2u - 2o - 2u - 2o - 2u$.
46. $2_R \longrightarrow 3_L$: $2u - 2o - 2u - 2o - 4u - 2o - 2u - 2o$.
47. $3_L \longrightarrow 1_R$: $2u - o - u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - u$.
48. $1_R \longrightarrow 1_L$: $o - 2u - 2o - 2u - 2o - 2u - 2o - 2u - 4o - 2u - 2o - 2u - 2o - 2u - 2o - u$.
49. $1_L \longrightarrow 3_R$: $2u - 2o - 2u - 2o - 2u - 2o - u - 2o - 2u - o$.
50. $3_R \longrightarrow 2_L$: $2o - 2u - 2o - u - 2o - 2u - 2o - 2u - 2o - 2u$.
51. $2_L \longrightarrow 2_R$: $u - 2o - 2u - 2o - 2u - 2o - 3u - 2o - u - 2o - u - 2o - 2u - 2o - 2u - 2o - 2u$.

52. $2_R \longrightarrow 3_L$: $2o - 2u - 2o - 2u - 2o - 4u - 2o - 2u - 2o$.
53. $3_L \longrightarrow 1_R$: $2u - 2o - u - 3o - 2u - 2o - 2u - 2o - 2u - 2o - u$.
54. $1_R \longrightarrow 1_L$: $2o - 2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - 2u - 3o - 2u - 2o - 2u - 2o - 2u - 2o - u$.

Euclid's algorithm, the path formula, the path in the RKT for the interbraided Regular Knots and their algorithm diagrams are shown in Fig. 1035.

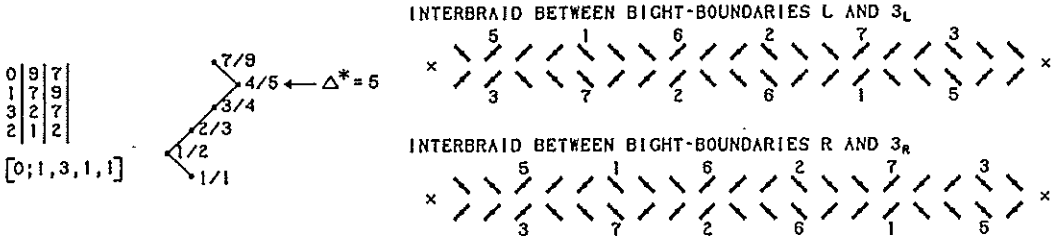

Fig. 1035 — Euclid's algorithm, path formula, path in RKT and algorithm diagrams for interbraided Regular Knots.

For the interbraided Regular Knot between the bight-boundaries L and 3_L we read the following half-cycle braiding algorithms from its algorithm diagram:

$1'$. : $u - 2o - 2u - 2o - 2u - 2o - 2u$.
$2'$. $(i = 0)$: $2u - 2o - 2u - 2o - 2u - 2o - u$.
$3'$. $(i = 0)$: $u - 2o - 2u - 2o - 2u - 2o - 2u$.
$4'$. $(i \leq 1)$: $2u - 2o - 3u - 2o - 2u - 2o - u$.
$5'$. $(i \leq 1)$: $u - 2o - 3u - 2o - 2u - 2o - 2u$.
$6'$. $(i \leq 2)$: $2u - 2o - 3u - 2o - 3u - 2o - u$.
$7'$. $(i \leq 2)$: $u - 2o - 3u - 2o - 3u - 2o - 2u$.
$8'$. $(i \leq 3)$: $2u - 2o - 3u - 2o - 3u - 2o - 2u$.
$9'$. $(i \leq 3)$: $u - 2o - 3u - 2o - 3u - 2o - 3u$.
$10'$. $(i \leq 4)$: $2u - 2o - 3u - 2o - 3u - 2o - 2u$.
$11'$. $(i \leq 4)$: $u - 2o - 3u - 2o - 3u - 2o - 3u$.
$12'$. $(i \leq 5)$: $2u - 3o - 3u - 2o - 3u - 2o - 2u$.
$13'$. $(i \leq 5)$: $u - 3o - 3u - 2o - 3u - 2o - 3u$.
$14'$. $(i \leq 6)$: $2u - 3o - 3u - 3o - 3u - 2o - 2u$.
$15'$. $(i \leq 6)$: $u - 3o - 3u - 3o - 3u - 2o - 3u$.
$16'$. $(i \leq 7)$: $2u - 3o - 3u - 3o - 3u - 3o - 2u$.
$17'$. $(i \leq 7)$: $u - 3o - 3u - 3o - 3u - 3o - 3u$.
$18'$. $(i \leq 8)$: $2u - 3o - 3u - 3o - 3u - 3o - 2u$.

The half-cycle braiding algorithms for the half-cycles $1''$-$18''$ of the interbraided Regular Knot between the bight-boundaries R and 3_R are identical to the ones above for the half-cycles $1'$-$18'$ of the interbraided Regular Knot between the bight-boundaries L and 3_L.

Note the string-run of the right-hand interbraided knots with the $''$ half-cycles in Fig. 1011 (in association with Figs. 1012, 1016, 1017), in Fig. 1024 (in association with Fig. 1025), and in Fig. 1031 (in association with Fig. 1032). The placing of the Standing Ends obviously simplifies the half-cycle braiding algorithms involved — refer to *The Braider*, Issue No. 53, pg. 1245.

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This publication is available to braiding artisans only.

Copies may be obtained from:

A.G. Schaake,
21 Sundown Cresc.,
Hamilton,
New Zealand.

A Braiding Project — Key-hanger No. 6

This is a key-hanger for a more special key which one doesn't carry around, but doesn't want to get misplaced. For this reason the key-hanger consists of a 43 mm. diameter golfball covered with a braid. Secured to the golfball is a short piece of chain (overall chain-length approximately 130 mm.) to which the key can then be attached.

In the golfball we drill a 9 mm. diameter hole to a depth of $\frac{4}{5}$ of the diameter of the golfball. In this hole we fasten a short piece of chain. On the equatorial diameter of the golfball we drill a 2 mm. diameter hole which passes diametrically through the 9 mm. hole. One end of the chain is then placed in the 9 mm. diameter hole so that this end rests against the bottom of this hole. Then through the 2 mm. diameter hole and a link of the chain we pass a nail which we file flush with the surface of the golfball. Next, the hole with chain is filled with araldite. After the araldite has properly hardened, we cover the golfball with a single layer of tape which has the colour of the cord used for the braid over the golfball. We can then slide the ball covering braid from its mandrel, on which it was braided, over the golfball with the string-ends towards the chain. The braid covering the golfball is made from 2 mm. diameter nylon cord and after doubling the braid followed by the removal of any projecting fibres with a spirit burner, the braided golfball is painted with a solution of 40% PVA glue and 60% water. After drying, lacquer the braid with a water-base lacquer.

Fig. 1036 depicts the string-run diagram of the braid covering the golfball. Ensure that during tightening of the braid the columns (which are the small circles) are parallel to the equatorial circle (which is the great circle).

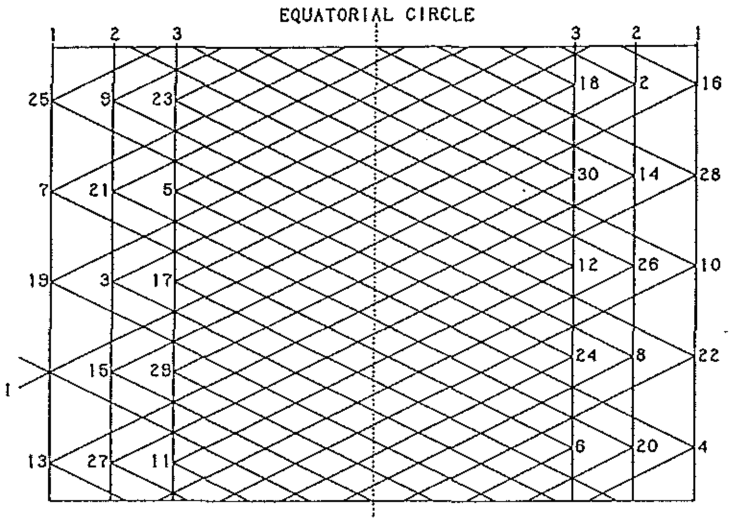


Fig. 1036 — The string-run diagram of the braid covering the golfball.

The first-return string-run of the braid covering the golfball is presented in Fig. 1037.

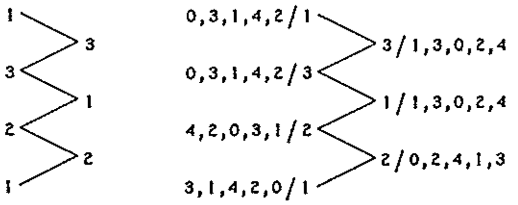
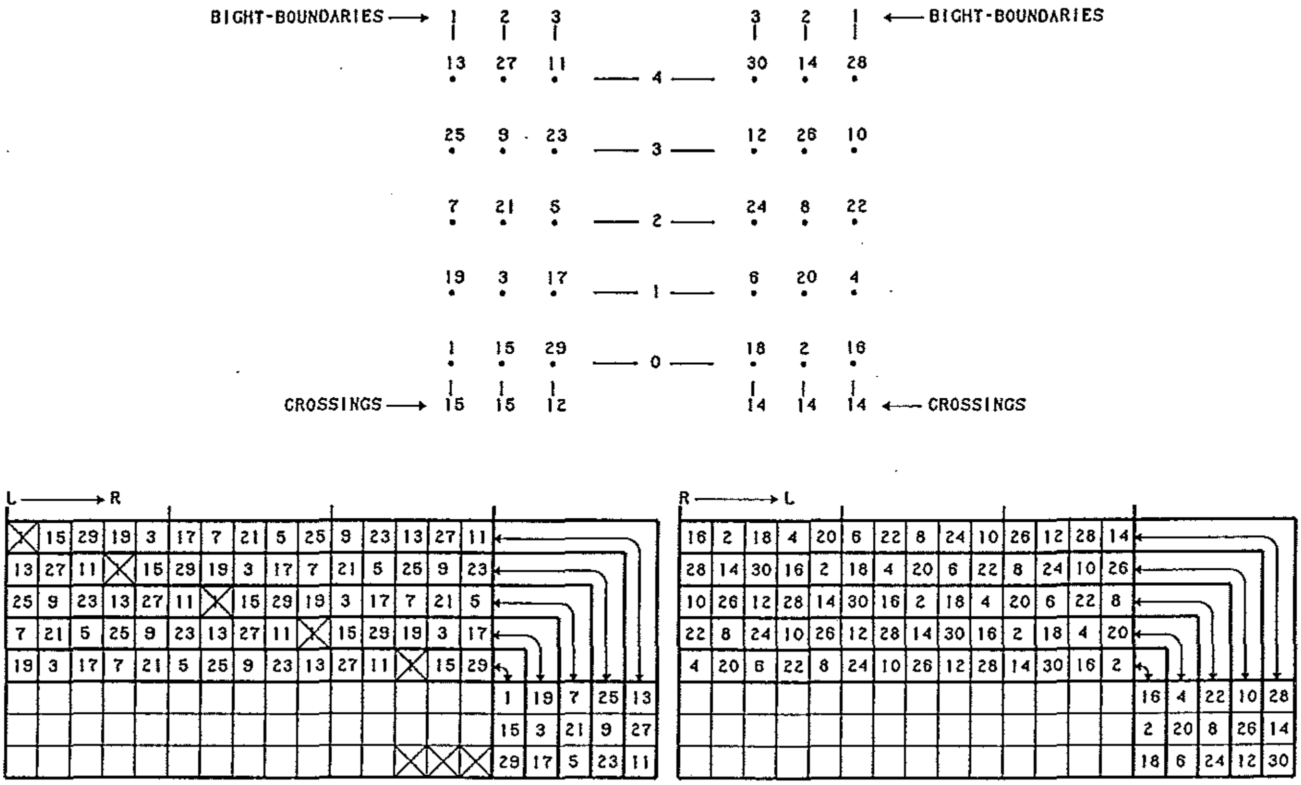


Fig. 1037 — The first-return string-run of the braid covering the golfball.

The half-cycle pattern associated with the string-run in Fig. 1036, and derived from the first-return string-run in Fig. 1037, together with the general half-cycle tables derived from this half-cycle pattern are presented in Fig. 1038.



☒	15	29	19	3	17	7	21	5	25	9	23	13	27	11					
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7	21	5	25	9	23	13	27	11	☒	15	29	19	3	17					
19	3	17	7	21	5	25	9	23	13	27	11	☒	15	29					
															1	19	7	25	13
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											☒	☒	☒		29	17	5	23	11

16	2	18	4	20	6	22	8	24	10	26	12	28	14					
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10	26	12	28	14	30	16	2	18	4	20	6	22	8					
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4	20	6	22	8	24	10	26	12	28	14	30	16	2					
														16	4	22	10	28
														2	20	8	26	14
														18	6	24	12	30

Fig. 1038 — Half-cycle pattern and general half-cycle tables.

Six of the several coding arrangements which can be superimposed on the string-run in Fig. 1036 are presented below.

Coding arrangement 1.

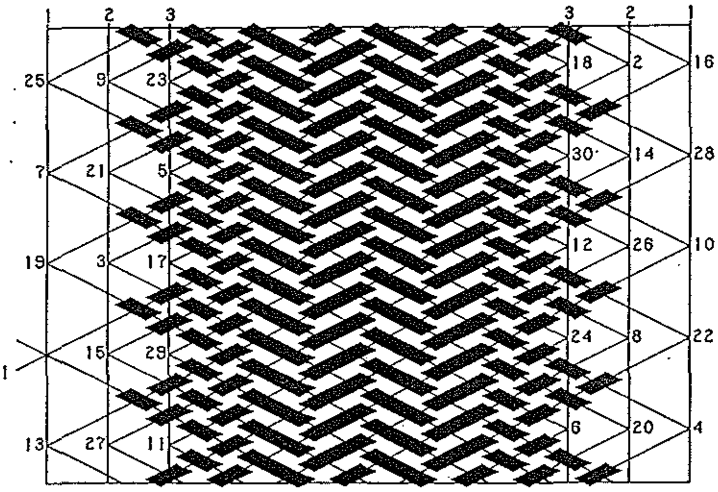


Fig. 1039 — Coding arrangement 1.

The half-cycle tables associated with coding arrangement 1 are presented in Fig. 1040. From these half-cycle tables we read the following half-cycle braiding algorithms:

half-cycle 1. $L_1 \longrightarrow R_2$: Free run.
half-cycle 2. $R_2 \longrightarrow L_2$: $(s)u$.

half-cycle 3. $L_2 \longrightarrow R_1$: u .
half-cycle 4. $R_1 \longrightarrow L_3$: $(s)o - u$.
half-cycle 5. $L_3 \longrightarrow R_3$: u .
half-cycle 6. $R_3 \longrightarrow L_1$: $(s,1)2u$.
half-cycle 7. $L_1 \longrightarrow R_2$: $o - 2u$.
half-cycle 8. $R_2 \longrightarrow L_2$: $(s)u - o - 2u$.
half-cycle 9. $L_2 \longrightarrow R_1$: $u - o - 2u$.
half-cycle 10. $R_1 \longrightarrow L_3$: $(s)u - o - u - o - u$.
half-cycle 11. $L_3 \longrightarrow R_3$: $o - u - o - u$.
half-cycle 12. $R_3 \longrightarrow L_1$: $(s)o - u - o - 2u$.
half-cycle 13. $L_1 \longrightarrow R_2$: $u - o - u - o - 2u$.
half-cycle 14. $R_2 \longrightarrow L_2$: $(s,1)2u - o - u - o - 2u$.

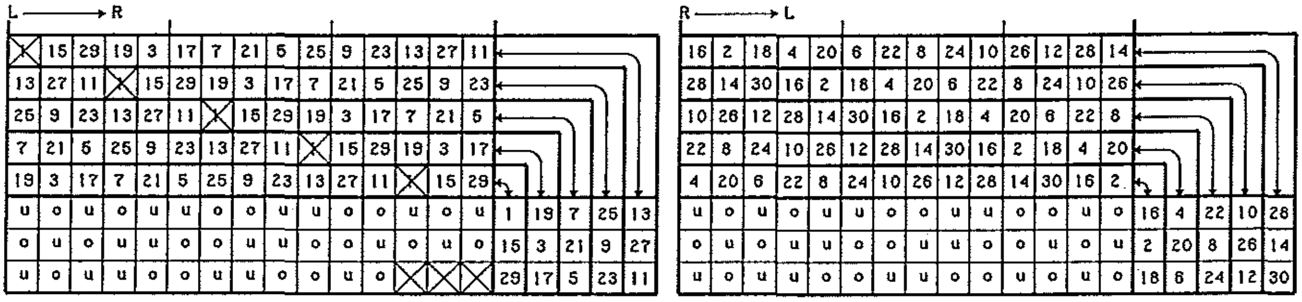


Fig. 1040 — Half-cycle tables associated with coding arrangement 1.

half-cycle 15. $L_2 \longrightarrow R_1$: $2u - o - u - o - 2u$.
half-cycle 16. $R_1 \longrightarrow L_3$: $3u - o - u - o - u - (s)o$.
half-cycle 17. $L_3 \longrightarrow R_3$: $2u - o - u - o - u$.
half-cycle 18. $R_3 \longrightarrow L_1$: $2u - o - u - o - 2u - (s)o$.
half-cycle 19. $L_1 \longrightarrow R_2$: $3u - o - u - o - u - o - u$.
half-cycle 20. $R_2 \longrightarrow L_2$: $2u - o - u - (1,s)2o - u - o - u$.
half-cycle 21. $L_2 \longrightarrow R_1$: $2u - o - u - 2o - u - o - u - o$.
half-cycle 22. $R_1 \longrightarrow L_3$: $3u - (1,s)2o - 2u - 2o - u - o$.
half-cycle 23. $L_3 \longrightarrow R_3$: $2u - o - 2u - 2o - u - o$.
half-cycle 24. $R_3 \longrightarrow L_1$: $2u - o - (1,s)2u - 2o - u - o - u - o$.
half-cycle 25. $L_1 \longrightarrow R_2$: $3u - 2o - 2u - 2o - u - o - u$.
half-cycle 26. $R_2 \longrightarrow L_2$: $(2,s)3u - 2o - 2u - 2o - u - o - u$.
half-cycle 27. $L_2 \longrightarrow R_1$: $3u - 2o - 2u - 2o - u - o - u - o$.
half-cycle 28. $R_1 \longrightarrow L_3$: $u - (s)o - u - o - 2u - 2o - 2u - 2o - u - o$.
half-cycle 29. $L_3 \longrightarrow R_3$: $u - o - 2u - 2o - 2u - 2o - u - o$.
half-cycle 30. $R_3 \longrightarrow L_1$: $u - (s)o - 2u - 2o - 2u - 2o - u - o - u - o$.

Coding arrangement 2.

Coding arrangement 2 is depicted in Fig. 1041.

The half-cycle tables associated with coding arrangement 2 are presented in Fig. 1042. From these half-cycle tables we read the following half-cycle braiding algorithms:

half-cycle 1. $L_1 \longrightarrow R_2$: Free run.
half-cycle 2. $R_2 \longrightarrow L_2$: $(s)u$.
half-cycle 3. $L_2 \longrightarrow R_1$: u .
half-cycle 4. $R_1 \longrightarrow L_3$: $(s,1)2u$.
half-cycle 5. $L_3 \longrightarrow R_3$: u .
half-cycle 6. $R_3 \longrightarrow L_1$: $(s,1)2u$.

half-cycle 7. $L_1 \longrightarrow R_2$: $3u$.
half-cycle 8. $R_2 \longrightarrow L_2$: $(s,3)4u$.
half-cycle 9. $L_2 \longrightarrow R_1$: $4u$.

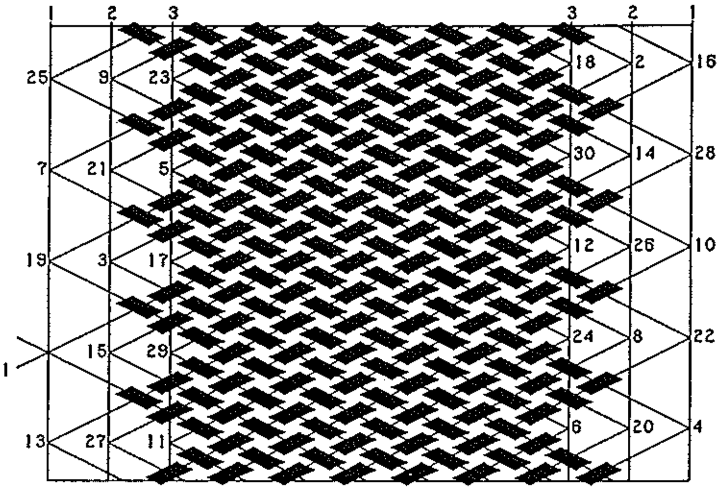
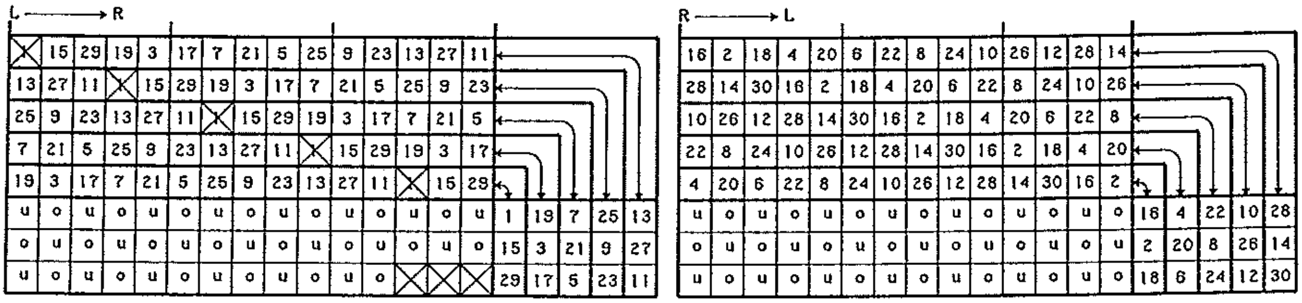


Fig. 1041 — Coding arrangement 2.

half-cycle 10. $R_1 \longrightarrow L_3$: $(s,4)5u$.
half-cycle 11. $L_3 \longrightarrow R_3$: $4u$.
half-cycle 12. $R_3 \longrightarrow L_1$: $(s,4)5u$.
half-cycle 13. $L_1 \longrightarrow R_2$: $6u$.
half-cycle 14. $R_2 \longrightarrow L_2$: $(s,6)7u$.



☒	15	29	19	3	17	7	21	5	25	9	23	13	27	11					
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o	u	o	u	o	u	o	u	o	u	o	u	o	u	o	15	3	21	9	27
u	o	u	o	u	o	u	o	u	o	u	o	☒	☒	☒	29	17	5	23	11

16	2	18	4	20	6	22	8	24	10	26	12	28	14					
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o	u	o	u	o	u	o	u	o	u	o	u	o	u	2	20	8	26	14
u	o	u	o	u	o	u	o	u	o	u	o	u	o	18	6	24	12	30

Fig. 1042 — Half-cycle tables associated with coding arrangement 2.

half-cycle 15. $L_2 \longrightarrow R_1$: $7u$.
half-cycle 16. $R_1 \longrightarrow L_3$: $7u-(s)o$.
half-cycle 17. $L_3 \longrightarrow R_3$: $6u$.
half-cycle 18. $R_3 \longrightarrow L_1$: $7u-(s)o$.
half-cycle 19. $L_1 \longrightarrow R_2$: $7u-o-u$.
half-cycle 20. $R_2 \longrightarrow L_2$: $5u-(s)o-u-o-u$.
half-cycle 21. $L_2 \longrightarrow R_1$: $5u-o-u-o-u-o$.
half-cycle 22. $R_1 \longrightarrow L_3$: $4u-(s)o-u-o-u-o-u-o$.
half-cycle 23. $L_3 \longrightarrow R_3$: $4u-o-u-o-u-o$.
half-cycle 24. $R_3 \longrightarrow L_1$: $4u-(s)o-u-o-u-o-u-o$.
half-cycle 25. $L_1 \longrightarrow R_2$: $4u-o-u-o-u-o-u-o-u$.
half-cycle 26. $R_2 \longrightarrow L_2$: $2u-(s)o-u-o-u-o-u-o-u-o-u$.
half-cycle 27. $L_2 \longrightarrow R_1$: $2u-o-u-o-u-o-u-o-u-o-u-o$.
half-cycle 28. $R_1 \longrightarrow L_3$: $u-(s)o-u-o-u-o-u-o-u-o-u-o-u-o$.
half-cycle 29. $L_3 \longrightarrow R_3$: $u-o-u-o-u-o-u-o-u-o-u-o$.

half-cycle 30. $R_3 \longrightarrow L_1$: $u-(s)o-u-o-u-o-u-o-u-o-u-o-u-o$.

Coding arrangement 3.

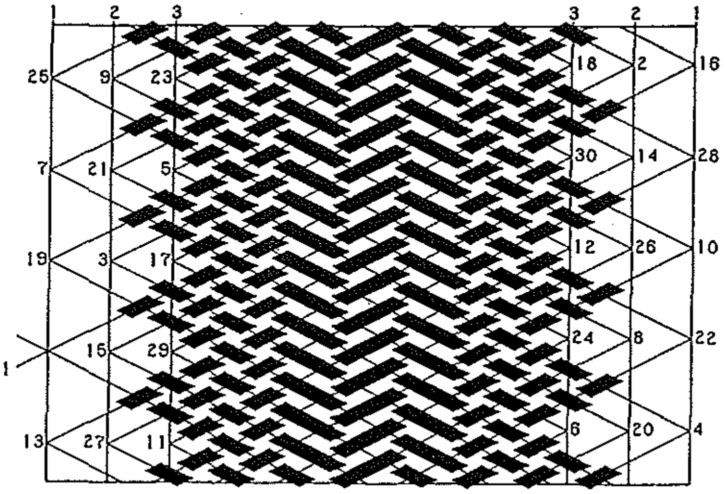
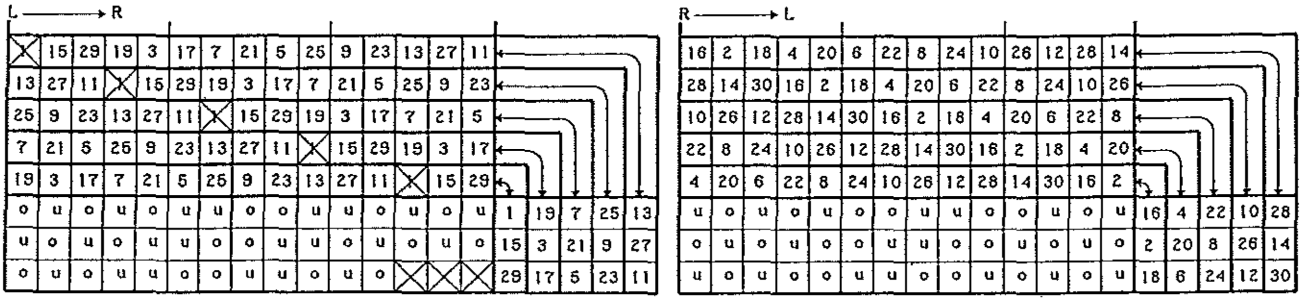


Fig. 1043 — Coding arrangement 3.

The half-cycle tables associated with coding arrangement 3 are presented in Fig. 1044. From these half-cycle tables we read the following half-cycle braiding algorithms:

half-cycle 1. $L_1 \longrightarrow R_2$: Free run.
half-cycle 2. $R_2 \longrightarrow L_2$: $(s)o$.
half-cycle 3. $L_2 \longrightarrow R_1$: u.
half-cycle 4. $R_1 \longrightarrow L_3$: $(s,1)2o$.
half-cycle 5. $L_3 \longrightarrow R_3$: u.
half-cycle 6. $R_3 \longrightarrow L_1$: $(s,1)2o$.
half-cycle 7. $L_1 \longrightarrow R_2$: $3u$.
half-cycle 8. $R_2 \longrightarrow L_2$: $(s)u-3o$.
half-cycle 9. $L_2 \longrightarrow R_1$: $o-3u$.
half-cycle 10. $R_1 \longrightarrow L_3$: $(s)u-o-u-2o$.
half-cycle 11. $L_3 \longrightarrow R_3$: $u-o-2u$.
half-cycle 12. $R_3 \longrightarrow L_1$: $(s)o-u-3o$.
half-cycle 13. $L_1 \longrightarrow R_2$: $o-u-o-3u$.
half-cycle 14. $R_2 \longrightarrow L_2$: $(s,1)2u-o-u-3o$.



L ⟶ R

☒	15	29	19	3	17	7	21	5	25	9	23	13	27	11					
13	27	11	☒	15	29	19	3	17	7	21	5	25	9	23					
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u	o	u	o	u	u	o	o	u	u	o	u	o	u	o	15	3	21	9	27
o	u	o	u	u	o	o	u	u	o	u	o	☒	☒	☒	29	17	5	23	11

R ⟶ L

16	2	18	4	20	6	22	8	24	10	26	12	28	14					
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10	26	12	28	14	30	16	2	18	4	20	6	22	8					
22	8	24	10	26	12	28	14	30	16	2	18	4	20					
4	20	6	22	8	24	10	26	12	28	14	30	16	2					
u	o	u	o	u	o	o	u	u	o	o	u	o	u	16	4	22	10	28
o	u	o	u	o	o	u	u	o	o	u	o	u	o	2	20	8	26	14
u	o	u	o	o	u	u	o	o	u	o	u	o	u	18	6	24	12	30

Fig. 1044 — Half-cycle tables associated with coding arrangement 3.

half-cycle 15. $L_2 \longrightarrow R_1$: $2o-u-o-3u$.
half-cycle 16. $R_1 \longrightarrow L_3$: $3u-o-u-2o-(s)u$.
half-cycle 17. $L_3 \longrightarrow R_3$: $2o-u-o-2u$.
half-cycle 18. $R_3 \longrightarrow L_1$: $2u-o-u-3o-(s)u$.
half-cycle 19. $L_1 \longrightarrow R_2$: $3o-u-o-2u-o-u$.

half-cycle 20. $R_2 \longrightarrow L_2$: $2u - o - u - o - (s)u - o - u - o$.
half-cycle 21. $L_2 \longrightarrow R_1$: $2o - u - o - u - o - u - o - u - o$.
half-cycle 22. $R_1 \longrightarrow L_3$: $3u - o - (s,1)2u - 2o - u - o - u$.
half-cycle 23. $L_3 \longrightarrow R_3$: $2o - u - o - 2u - o - u - o$.
half-cycle 24. $R_3 \longrightarrow L_1$: $2u - o - u - (s,1)2o - u - o - u - o - u$.
half-cycle 25. $L_1 \longrightarrow R_2$: $3o - u - 2o - 2u - o - u - o - u$.
half-cycle 26. $R_2 \longrightarrow L_2$: $2u - (s,1)2o - 2u - 2o - u - o - u - o$.
half-cycle 27. $L_2 \longrightarrow R_1$: $2o - 2u - 2o - 2u - o - u - o - u - o$.
half-cycle 28. $R_1 \longrightarrow L_3$: $u - (s)o - u - o - u - 2o - 2u - 2o - u - o - u$.
half-cycle 29. $L_3 \longrightarrow R_3$: $o - u - o - 2u - 2o - 2u - o - u - o$.
half-cycle 30. $R_3 \longrightarrow L_1$: $u - (s)o - u - 2o - 2u - 2o - u - o - u - o - u$.

Coding arrangement 4.

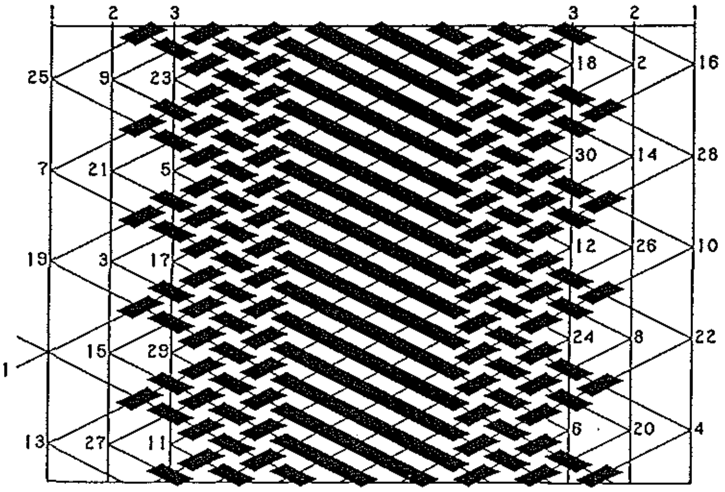
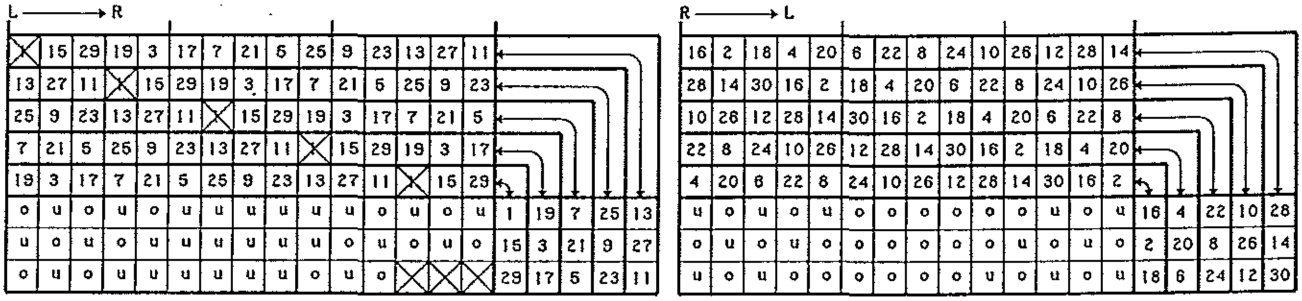


Fig. 1045 — Coding arrangement 4.

The half-cycle tables associated with coding arrangement 4 are presented in Fig. 1046. From these half-cycle tables we read the following half-cycle braiding algorithms:

half-cycle 1. $L_1 \longrightarrow R_2$: Free run.
half-cycle 2. $R_2 \longrightarrow L_2$: $(s)o$.
half-cycle 3. $L_2 \longrightarrow R_1$: u.
half-cycle 4. $R_1 \longrightarrow L_3$: $(s,1)2o$.



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u	o	u	o	u	u	u	u	u	u	o	u	o	u	o	15	3	21	9	27
o	u	o	u	u	u	u	u	u	o	u	o	☒	☒	☒	29	17	5	23	11

16	2	18	4	20	6	22	8	24	10	26	12	28	14					
28	14	30	16	2	18	4	20	6	22	8	24	10	26					
10	26	12	28	14	30	16	2	18	4	20	6	22	8					
22	8	24	10	26	12	28	14	30	16	2	18	4	20					
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o	u	o	u	o	o	o	o	o	o	u	o	u	o	2	20	8	26	14
u	o	u	o	o	o	o	o	o	u	o	u	o	u	18	6	24	12	30

Fig. 1046 — Half-cycle tables associated with coding arrangement 4.

half-cycle 5. $L_3 \longrightarrow R_3$: u.
half-cycle 6. $R_3 \longrightarrow L_1$: $(s,1)2o$.
half-cycle 7. $L_1 \longrightarrow R_2$: $3u$.
half-cycle 8. $R_2 \longrightarrow L_2$: $(s,3)4o$.
half-cycle 9. $L_2 \longrightarrow R_1$: $4u$.

half-cycle 10. $R_1 \longrightarrow L_3$: $(s)u - 4o$.
half-cycle 11. $L_3 \longrightarrow R_3$: $4u$.
half-cycle 12. $R_3 \longrightarrow L_1$: $(s,4)5o$.
half-cycle 13. $L_1 \longrightarrow R_2$: $o - 5u$.
half-cycle 14. $R_2 \longrightarrow L_2$: $(s,1)2u - 5o$.
half-cycle 15. $L_2 \longrightarrow R_1$: $2o - 5u$.
half-cycle 16. $R_1 \longrightarrow L_3$: $3u - 4o - (s)u$.
half-cycle 17. $L_3 \longrightarrow R_3$: $2o - 4u$.
half-cycle 18. $R_3 \longrightarrow L_1$: $2u - 5o - (s)u$.
half-cycle 19. $L_1 \longrightarrow R_2$: $3o - 4u - o - u$.
half-cycle 20. $R_2 \longrightarrow L_2$: $2u - 3o - (s)u - o - u - o$.
half-cycle 21. $L_2 \longrightarrow R_1$: $2o - 3u - o - u - o - u - o$.
half-cycle 22. $R_1 \longrightarrow L_3$: $3u - (1,s,3)5o - u - o - u$.
half-cycle 23. $L_3 \longrightarrow R_3$: $2o - 4u - o - u - o$.
half-cycle 24. $R_3 \longrightarrow L_1$: $2u - (2,s,1)4o - u - o - u - o - u$.
half-cycle 25. $L_1 \longrightarrow R_2$: $3o - 5u - o - u - o - u$.
half-cycle 26. $R_2 \longrightarrow L_2$: $2u - (s,5)6o - u - o - u - o$.
half-cycle 27. $L_2 \longrightarrow R_1$: $2o - 6u - o - u - o - u - o$.
half-cycle 28. $R_1 \longrightarrow L_3$: $u - (s)o - u - o - u - 6o - u - o - u$.
half-cycle 29. $L_3 \longrightarrow R_3$: $o - u - o - 6u - o - u - o$.
half-cycle 30. $R_3 \longrightarrow L_1$: $u - (s)o - u - 6o - u - o - u - o - u$.

Coding arrangement 5.

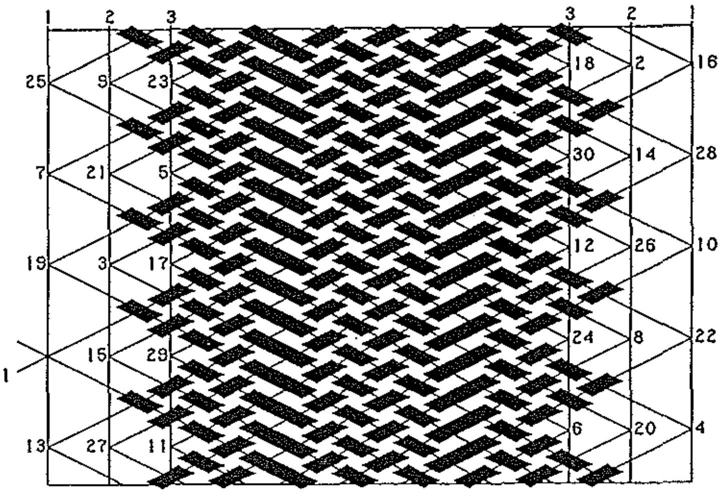
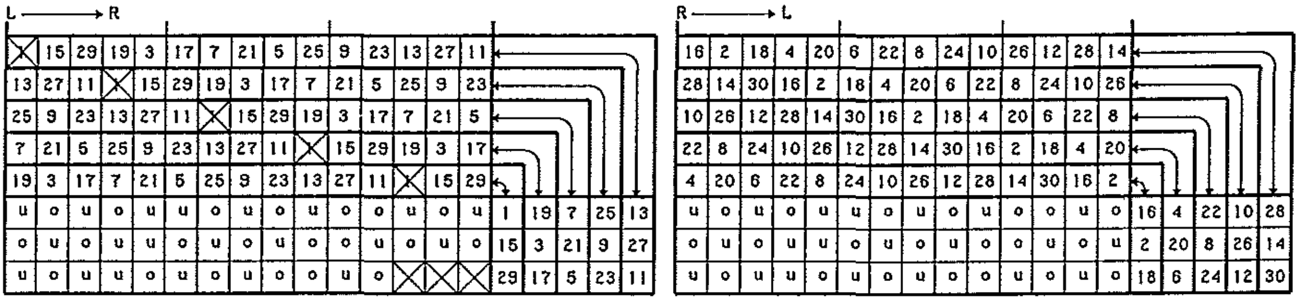


Fig. 1047 — Coding arrangement 5.

The half-cycle tables associated with coding arrangement 5 are presented in Fig. 1048. From these half-cycle tables we read the following half-cycle braiding algorithms:

half-cycle 1. $L_1 \longrightarrow R_2$: Free run.
half-cycle 2. $R_2 \longrightarrow L_2$: $(s)u$.
half-cycle 3. $L_2 \longrightarrow R_1$: u.
half-cycle 4. $R_1 \longrightarrow L_3$: $(s)o - u$.
half-cycle 5. $L_3 \longrightarrow R_3$: u.
half-cycle 6. $R_3 \longrightarrow L_1$: $(s,1)2u$.
half-cycle 7. $L_1 \longrightarrow R_2$: $o - 2u$.
half-cycle 8. $R_2 \longrightarrow L_2$: $(s,1)2o - 2u$.
half-cycle 9. $L_2 \longrightarrow R_1$: $2o - 2u$.

half-cycle 10. $R_1 \longrightarrow L_3$: $(s)u - 3o - u$.
half-cycle 11. $L_3 \longrightarrow R_3$: $3o - u$.
half-cycle 12. $R_3 \longrightarrow L_1$: $(s, 2)3o - 2u$.
half-cycle 13. $L_1 \longrightarrow R_2$: $u - 3o - 2u$.
half-cycle 14. $R_2 \longrightarrow L_2$: $(s, 1)2u - 3o - 2u$.



☒	15	29	19	3	17	7	21	5	25	9	23	13	27	11					
13	27	11	☒	15	29	19	3	17	7	21	5	25	9	23					
25	9	23	13	27	11	☒	15	29	19	3	17	7	21	5					
7	21	5	25	9	23	13	27	11	☒	15	29	19	3	17					
19	3	17	7	21	5	25	9	23	13	27	11	☒	15	29					
u	o	u	o	u	u	o	u	o	u	o	o	u	o	u	1	19	7	25	13
o	u	o	u	u	o	u	o	u	o	o	u	o	u	o	15	3	21	9	27
u	o	u	u	o	u	o	u	o	o	u	o	☒	☒	☒	29	17	5	23	11

16	2	18	4	20	6	22	8	24	10	26	12	28	14					
28	14	30	16	2	18	4	20	6	22	8	24	10	26					
10	26	12	28	14	30	16	2	18	4	20	6	22	8					
22	8	24	10	26	12	28	14	30	16	2	18	4	20					
4	20	6	22	8	24	10	26	12	28	14	30	16	2					
u	o	u	o	u	u	o	u	o	u	o	o	u	o	16	4	22	10	28
o	u	o	u	u	o	u	o	u	o	o	u	o	u	2	20	8	26	14
u	o	u	u	o	u	o	u	o	o	u	o	u	o	18	6	24	12	30

Fig. 1048 — Half-cycle tables associated with coding arrangement 5.

half-cycle 15. $L_2 \longrightarrow R_1$: $2u - 3o - 2u$.
half-cycle 16. $R_1 \longrightarrow L_3$: $3u - 3o - u - (s)o$.
half-cycle 17. $L_3 \longrightarrow R_3$: $2u - 3o - u$.
half-cycle 18. $R_3 \longrightarrow L_1$: $2u - 3o - 2u - (s)o$.
half-cycle 19. $L_1 \longrightarrow R_2$: $3u - 3o - u - o - u$.
half-cycle 20. $R_2 \longrightarrow L_2$: $2u - (3, s)4o - u - o - u$.
half-cycle 21. $L_2 \longrightarrow R_1$: $2u - 4o - u - o - u - o$.
half-cycle 22. $R_1 \longrightarrow L_3$: $3u - o - (s)u - o - u - 2o - u - o$.
half-cycle 23. $L_3 \longrightarrow R_3$: $2u - 2o - u - 2o - u - o$.
half-cycle 24. $R_3 \longrightarrow L_1$: $2u - 2o - (s)u - 2o - u - o - u - o$.
half-cycle 25. $L_1 \longrightarrow R_2$: $3u - o - u - o - u - 2o - u - o - u$.
half-cycle 26. $R_2 \longrightarrow L_2$: $(2, s)3u - o - u - o - u - 2o - u - o - u$.
half-cycle 27. $L_2 \longrightarrow R_1$: $3u - o - u - o - u - 2o - u - o - u - o$.
half-cycle 28. $R_1 \longrightarrow L_3$: $u - (s)o - u - o - 2u - o - u - o - u - 2o - u - o$.
half-cycle 29. $L_3 \longrightarrow R_3$: $u - o - 2u - o - u - o - u - 2o - u - o$.
half-cycle 30. $R_3 \longrightarrow L_1$: $u - (s)o - 2u - o - u - o - u - 2o - u - o - u - o$.

Coding arrangement 6.

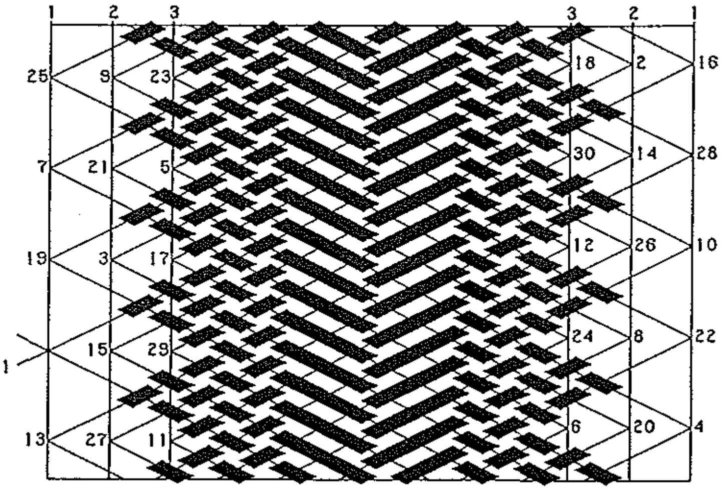
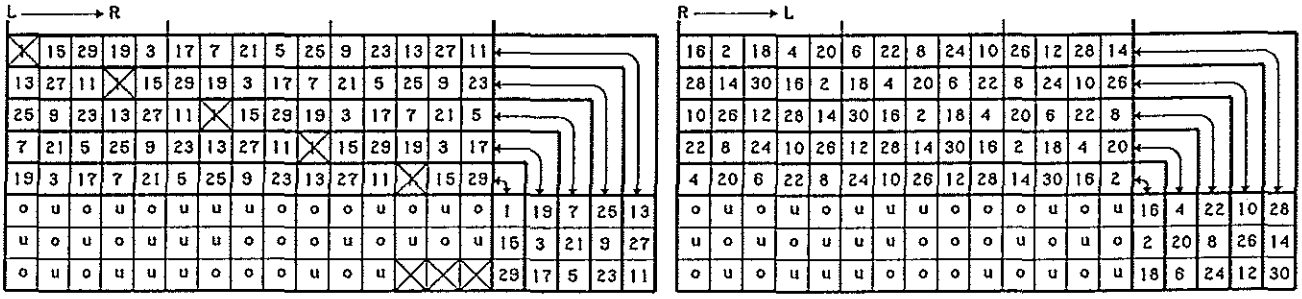


Fig. 1049 — Coding arrangement 6.

The half-cycle tables associated with coding arrangement 6 are presented in Fig. 1050.

From these half-cycle tables we read the following half-cycle braiding algorithms:

half-cycle 1. $L_1 \longrightarrow R_2$: Free run.
half-cycle 2. $R_2 \longrightarrow L_2$: $(s)o$.
half-cycle 3. $L_2 \longrightarrow R_1$: o .
half-cycle 4. $R_1 \longrightarrow L_3$: $(s,1)2o$.
half-cycle 5. $L_3 \longrightarrow R_3$: o .
half-cycle 6. $R_3 \longrightarrow L_1$: $(s,1)2o$.
half-cycle 7. $L_1 \longrightarrow R_2$: $3o$.
half-cycle 8. $R_2 \longrightarrow L_2$: $(s,3)4o$.
half-cycle 9. $L_2 \longrightarrow R_1$: $4o$.
half-cycle 10. $R_1 \longrightarrow L_3$: $(s)o - u - 3o$.
half-cycle 11. $L_3 \longrightarrow R_3$: $u - 3o$.
half-cycle 12. $R_3 \longrightarrow L_1$: $(s)u - 4o$.
half-cycle 13. $L_1 \longrightarrow R_2$: $o - u - 4o$.
half-cycle 14. $R_2 \longrightarrow L_2$: $(s,1)2o - u - 4o$.



L → R

☒	15	29	19	3	17	7	21	5	25	9	23	13	27	11					
13	27	11	☒	15	29	19	3	17	7	21	5	25	9	23					
25	9	23	13	27	11	☒	15	29	19	3	17	7	21	5					
7	21	5	25	9	23	13	27	11	☒	15	29	19	3	17					
19	3	17	7	21	5	25	9	23	13	27	11	☒	15	29					
o	u	o	u	o	u	u	u	o	o	o	u	o	u	o	1	19	7	25	13
u	o	u	o	u	u	u	o	o	o	u	o	u	o	u	15	3	21	9	27
o	u	o	u	u	u	o	o	o	u	o	u	☒	☒	☒	29	17	5	23	11

R → L

16	2	18	4	20	6	22	8	24	10	26	12	28	14					
28	14	30	16	2	18	4	20	6	22	8	24	10	26					
10	26	12	28	14	30	16	2	18	4	20	6	22	8					
22	8	24	10	26	12	28	14	30	16	2	18	4	20					
4	20	6	22	8	24	10	26	12	28	14	30	16	2					
o	u	o	u	o	u	u	u	o	o	o	u	o	u	16	4	22	10	28
u	o	u	o	u	u	u	o	o	o	u	o	u	o	2	20	8	26	14
o	u	o	u	u	u	o	o	o	u	o	u	o	u	18	6	24	12	30

Fig. 1050 — Half-cycle tables associated with coding arrangement 6.

half-cycle 15. $L_2 \longrightarrow R_1$: $2o - u - 4o$.
half-cycle 16. $R_1 \longrightarrow L_3$: $3o - u - 3o - (s)u$.
half-cycle 17. $L_3 \longrightarrow R_3$: $2o - u - 3o$.
half-cycle 18. $R_3 \longrightarrow L_1$: $2o - u - 4o - (s)u$.
half-cycle 19. $L_1 \longrightarrow R_2$: $3o - u - 3o - u - o$.
half-cycle 20. $R_2 \longrightarrow L_2$: $2o - u - 2o - (s)u - o - u - o$.
half-cycle 21. $L_2 \longrightarrow R_1$: $2o - u - 2o - u - o - u - o - u$.
half-cycle 22. $R_1 \longrightarrow L_3$: $3o - (1,s)2u - 3o - u - o - u$.
half-cycle 23. $L_3 \longrightarrow R_3$: $2o - u - 3o - u - o - u$.
half-cycle 24. $R_3 \longrightarrow L_1$: $2o - u - (1,s,1)3o - u - o - u - o - u$.
half-cycle 25. $L_1 \longrightarrow R_2$: $3o - 2u - 3o - u - o - u - o$.
half-cycle 26. $R_2 \longrightarrow L_2$: $2o - (s,2)3u - 3o - u - o - u - o$.
half-cycle 27. $L_2 \longrightarrow R_1$: $2o - 3u - 3o - u - o - u - o - u$.
half-cycle 28. $R_1 \longrightarrow L_3$: $o - (s)u - o - u - o - 3u - 3o - u - o - u$.
half-cycle 29. $L_3 \longrightarrow R_3$: $o - u - o - 3u - 3o - u - o - u$.
half-cycle 30. $R_3 \longrightarrow L_1$: $o - (s)u - o - 3u - 3o - u - o - u - o - u$.

Interbraided Cylindrical Braids

The importance of the value of $\frac{\beta}{\alpha} = \frac{\beta'}{\alpha'}$ for the foundation knot of the "new" type of Interbraided Cylindrical Braids will have been evident since its value for the first-return string-run of the foundation knot determines, for a given value of λ for the foundation knot, the possible values of its B_c. Since it is in general easier to obtain the values for β' associated with their circumferential bight-boundaries than the value for β, we can obtain the value for β from $\beta = \dfrac{\beta' \cdot \alpha}{\alpha'}$ and the value for B_c from $B_c = \dfrac{B_c{}' \cdot \alpha}{\alpha'}$.

Note that in *The Braider*, Issue No. 53, Example 3 — pg. 1265, $\beta = 66$ is associated with $2C_1 + C_2 + 2C_3$ and $\alpha = 3$; in *The Braider*, Issue No. 54, Fig. 1003 — pg. 1273, $\beta' = 44$ on 1_L is associated with $2C_1 + C_2 + 2C_3$ and $\alpha' = 2$; in *The Braider*, Issue No. 54, Example 1 — pg. 1278, $\beta = 90$ is associated with $3C_2 + 2C_1 + 2C_3$ and $\alpha = 3$; in *The Braider*, Issue No. 54, Example 3 — pg. 1289, $\beta = 99$ is associated with $3C_2 + 2C_1 + 2C_3$ and $\alpha = 3$; in *The Braider*, Issue No. 54, Example 4 — pg. 1293, $\beta = 111$ is associated with $4C_1 + 4C_2 + 3C_3$ and $\alpha = 3$.

In the previous Issues, No. 53 and No. 54, we gave for the foundation knot the numerical values for the essential parameters of its first-return string-run. In the following Examples we will first derive these numerical values for the string-run of a viable first-return string-run for the foundation knot.

Example 1.

Let Fig. 1051 depict the first-return string-run in the foundation knot. Let the bights on L_1 occupy all bight-index numbers and let the bights on R_2 and L_2 be string-run wise in line with each other so that their positions are also the positions of the bights of the interbraid between the bight-boundaries R_2 and L_2. Hence the repeat-period of identical string-run half-cycle types is 3. Consequently $|2C_1|_3 \neq |C_1|_3 \neq 0$, while $|3C_1 + C_2 + 3C_3|_3 = |C_2|_3 = 0$. Furthermore $|2C_1 + 2C_3|_3 \neq |2C_1 + C_3|_3 \neq |2C_1|_3$. With $C_1 = 11$ we have the identical bight-index types $0 + 3n$ and the identical bight-index types $|C_1|_3 + 3n = |11|_3 + 3n = 2 + 3n$ on bight-boundary R_2; furthermore with $C_3 = 11$ we have the identical bight-index types $|2C_1 + C_3|_3 + 3n = |33|_3 + 3n = 0 + 3n$ and the identical bight-index types $|2C_1 + 2C_3|_3 + 3n = |44|_3 + 3n = 2 + 3n$ on bight-boundary L_2. With $C_2 = 15$ we have $|C_2|_3 = |15|_3 = 0$.

Since the bights on the bight-boundaries R_2 and L_2 are string-run wise in line with each other, $3C_1 + C_2 + 3C_3 = 33 + 15 + 33 = 81 = \beta'$ associated with circumferential bight-boundary L_1 and hence with $\alpha' = 3$. $\beta = \dfrac{\beta' \cdot \alpha}{\alpha'}$, hence with $\alpha = 5$ and $\alpha' = 3$, we obtain $\beta = \dfrac{81 \times 5}{3} = 135$. We thus obtain for $\dfrac{\beta}{\alpha} = \dfrac{\beta'}{\alpha'}$ the value $\dfrac{135}{5} = \dfrac{81}{3} = 27$. Thus for $\lambda = 1$, $\dfrac{B_c{}'}{\alpha'} = \dfrac{B_c{}'}{3}$ on bight-boundary L_1 must be coprime with 27. $\dfrac{B_c{}'}{3} = 8$ and hence $B_c{}' = 3 \times 8 = 24$ on bight-boundary L_1 fulfils this condition.

Note that this foundation knot has $B_c = 8 \times \alpha = 8 \times 5 = 40$ bights.

Every repeat-period of 3 has on bight-boundary R_2 two bights, hence the interbraid between the bight-boundaries R_2 and L_2 has $\dfrac{24}{3} \times 2 = 16$ bights. Its number of parts is equal to $\dfrac{C_2}{3} \times 2 = \dfrac{15}{3} \times 2 = 10$. Hence $\lambda = \text{g.c.d.}(p, b) = \text{g.c.d.}(10, 16) = 2$ for the interbraid between the bight-boundaries R_2 and L_2. Thus the interbraid between the bight-boundaries R_2 and L_2 consists of two components, where each component is a Regular Knot with $p/b = 5/8$.

The above examination of the general layout of the first-return string-run for the foundation knot is the essential first step in the design of the foundation knot for this "new" type of interbraids. It supplies, for a viable foundation knot, the numerical values for the essential parameters of its string-run. Only after these numerical values have been established can the string-run diagram of a viable foundation knot be drawn up. After the examination of the general layout of the first-return string-run for the foundation knot, we examine the string-run of the interbraid and determine its parameters. This then enables us to draw the complete string-run of the interbraided knot.

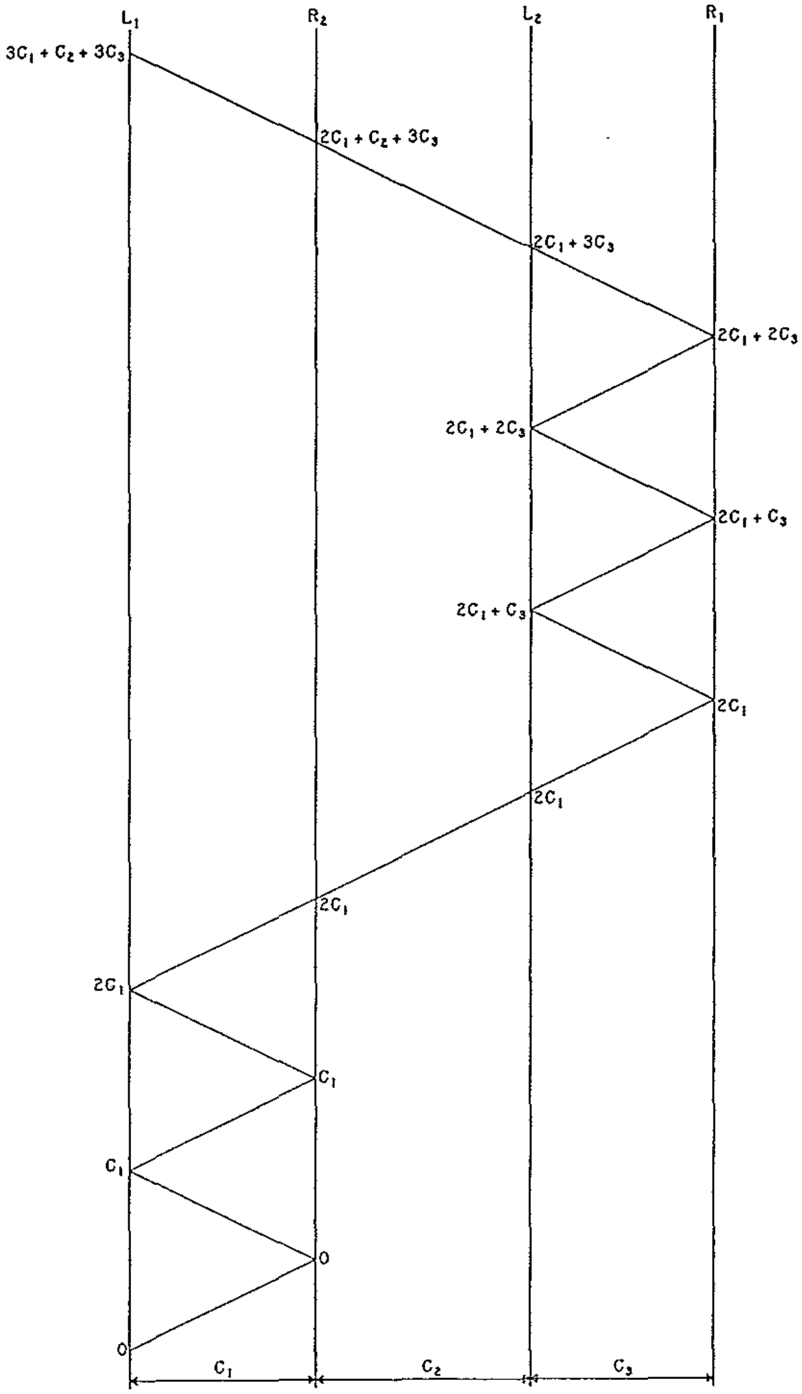


Fig. 1051 — The first-return string-run of the foundation knot.

The upper diagram in Fig. 1052 depicts the string-run diagram of the foundation knot and the lower diagram in Fig. 1052 depicts the string-runs of the two interbraided Regular Knot components between the bight-boundaries R_2 and L_2.

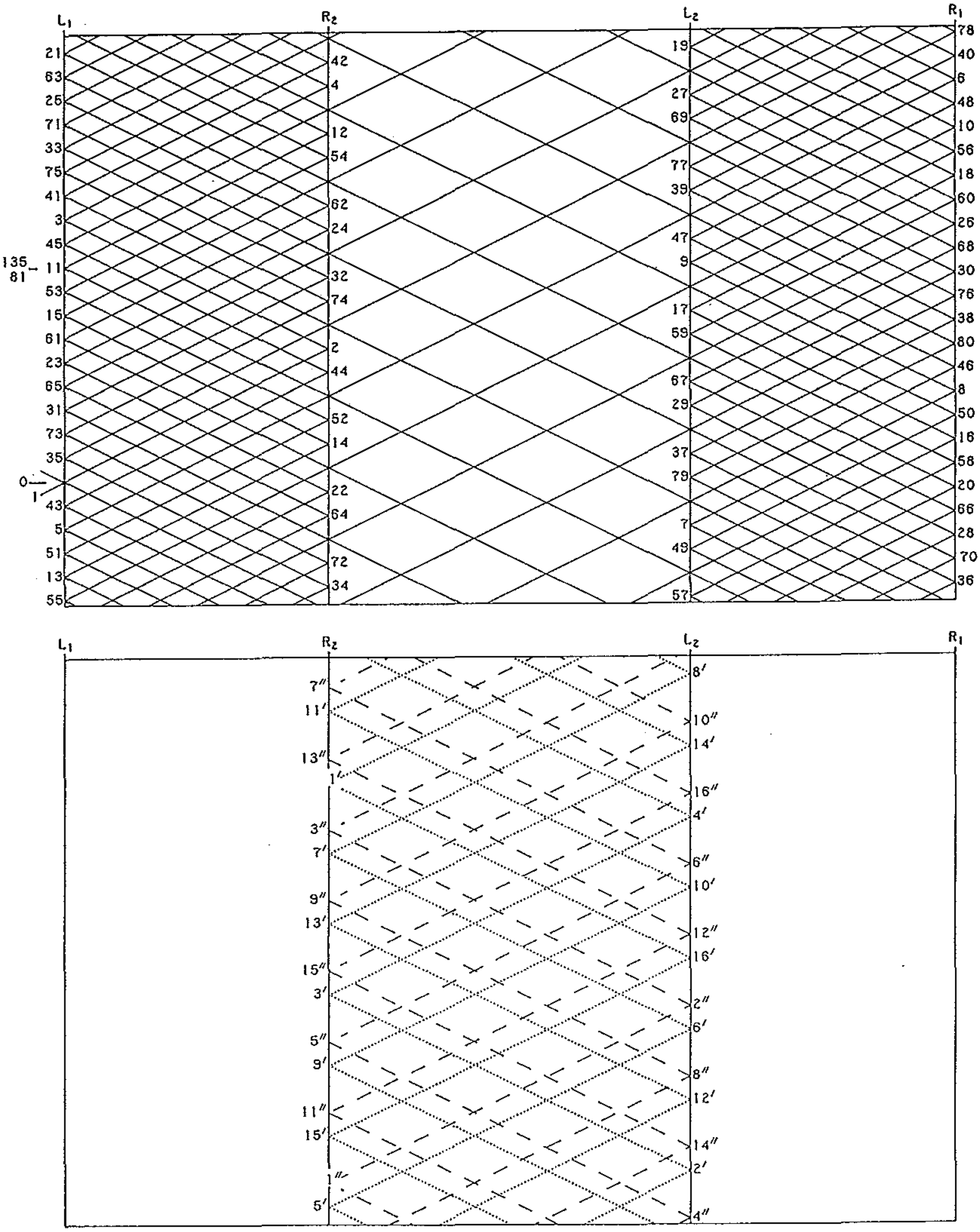


Fig. 1052 — The string-runs of the foundation knot and the interbraided Regular Knot components.

On the overall string-run of the Interbraided Cylindrical Braid so obtained, we can then superimpose a suitable coding. Such a superimposed coding on this overall string-run is shown in Fig. 1053.

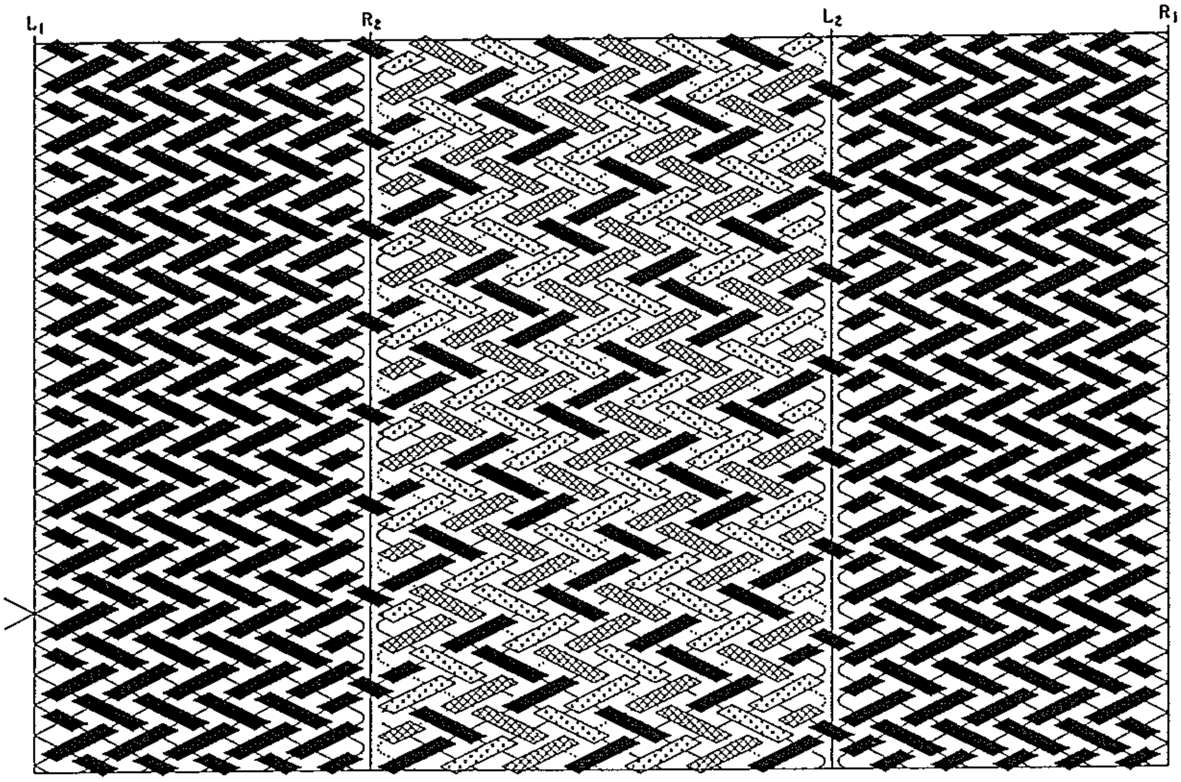


Fig. 1053 — The grid-diagram of the Interbraided Cylindrical Braid.

The half-cycle braiding algorithms for the foundation knot can be read from the tables in Fig. 1054 and Fig. 1055 as follows:

1. $L_1 \longrightarrow R_2$: Free run.
2. $R_2 \longrightarrow L_1$: Free run.
3. $L_1 \longrightarrow R_2$: Free run.
4. $R_2 \longrightarrow L_1$: Free run.
5. $L_1 \longrightarrow R_1$: Free run.
6. $R_1 \longrightarrow L_2$: Free run.
7. $L_2 \longrightarrow R_1$: Free run.
8. $R_1 \longrightarrow L_2$: Free run.
9. $L_2 \longrightarrow R_1$: Free run.
10. $R_1 \longrightarrow L_1$: $3o$.
11. $L_1 \longrightarrow R_2$: o.
12. $R_2 \longrightarrow L_1$: u.
13. $L_1 \longrightarrow R_2$: u.
14. $R_2 \longrightarrow L_1$: $o - u$.
15. $L_1 \longrightarrow R_2$: $o - 2u - o$.
16. $R_2 \longrightarrow L_1$: u.
17. $L_1 \longrightarrow R_1$: u.
18. $R_1 \longrightarrow L_2$: $o - u$.
19. $L_2 \longrightarrow R_1$: $o - u$.
20. $R_1 \longrightarrow L_1$: $u - 3o - u - o$.
21. $L_1 \longrightarrow R_2$: $u - o$.
22. $R_2 \longrightarrow L_1$: $o - u - o$.
23. $L_1 \longrightarrow R_2$: $o - u - o$.

24. $R_2 \longrightarrow L_1$: $u - o - u$.
25. $L_1 \longrightarrow R_2$: $u - o - 4u - o$.

HALF-CYCLE										
1	35	73	31	65	23	61	15	53	11	45
21	55	13	51	5	43	╳	35	73	31	65
41	75	33	71	25	63	21	55	13	51	5
61	15	53	11	45	3	41	75	33	71	25
	U	U	O	O	U	U	O	O	U	O

HALF-CYCLE										
3	41	75	33	71	25	63	21	55	13	51
23	61	15	53	11	45	3	41	75	33	71
43	╳	35	73	31	65	23	61	15	53	11
63	21	55	13	51	5	43	╳	35	73	31
	O	O	U	U	O	O	U	U	O	O

HALF-CYCLE										
11	45	3	41	75	33	71	25	63	21	55
31	65	23	61	15	53	11	45	3	41	75
51	5	43	╳	35	73	31	65	23	61	15
71	25	63	21	55	13	51	5	43	╳	35
	O	O	U	U	O	O	U	U	O	O

HALF-CYCLE										
13	51	5	43	╳	35	73	31	65	23	61
33	71	25	63	21	55	13	51	5	43	╳
53	11	45	3	41	75	33	71	25	63	21
73	31	65	23	61	15	53	11	45	3	41
	U	U	O	O	U	U	O	O	U	O

HALF-CYCLE										
7	41	79	37	71	29	67	21	59	17	51
27	61	19	57	11	49	7	41	79	37	71
47	╳	39	77	31	69	27	61	19	57	11
67	21	59	17	51	9	47	╳	39	77	31
	O	O	U	U	O	O	U	U	O	O

HALF-CYCLE										
9	47	╳	39	77	31	69	27	61	19	57
29	67	21	59	17	51	9	47	╳	39	77
49	7	41	79	37	71	29	67	21	59	17
69	27	61	19	57	11	49	7	41	79	37
	O	U	O	O	U	U	O	O	U	U

HALF-CYCLE										
17	51	9	47	╳	39	77	31	69	27	61
37	71	29	67	21	59	17	51	9	47	╳
57	11	49	7	41	79	37	71	29	67	21
77	31	69	27	61	19	57	11	49	7	41
	O	U	O	O	U	U	O	O	U	U

HALF-CYCLE										
19	57	11	49	7	41	79	37	71	29	67
39	77	31	69	27	61	19	57	11	49	7
59	17	51	9	47	╳	39	77	31	69	27
79	37	71	29	67	21	59	17	51	9	47
	O	O	U	U	O	O	U	U	O	O

HALF-CYCLE																									
5	43	╳	35	73	31	65	23	61	15	53	11	41	71	21	51	╳	39	77	31	69	27	61	19	57	11	49
25	63	21	55	13	51	5	43	╳	35	73	31	61	11	41	71	21	59	17	51	9	47	╳	39	77	31	69
45	3	41	75	33	71	25	63	21	55	13	51	╳	31	61	11	41	79	37	71	29	67	21	59	17	51	9
65	23	61	15	53	11	45	3	41	75	33	71	21	51	╳	31	61	19	57	11	49	7	41	79	37	71	29
	U	U	O	O	U	U	O	O	U	O	U	O	U	U	O	U	O	U	O	O	U	U	O	O	U	U

HALF-CYCLE																									
15	53	11	45	3	41	75	33	71	25	63	21	51	╳	31	61	11	49	7	41	79	37	71	29	67	21	59
35	73	31	65	23	61	15	53	11	45	3	41	71	21	51	╳	31	69	27	61	19	57	11	49	7	41	79
55	13	51	5	43	╳	35	73	31	65	23	61	11	41	71	21	51	9	47	╳	39	77	31	69	27	61	19
75	33	71	25	63	21	55	13	51	5	43	╳	31	61	11	41	71	29	67	21	59	17	51	9	47	╳	39
	O	O	U	U	O	O	U	U	O	O	U	U	O	O	U	U	O	O	U	U	O	O	U	U	O	O

Fig. 1054 — Tables for the odd-numbered half-cycles.

26. $R_2 \longrightarrow L_1$: $o - u - o$.
27. $L_1 \longrightarrow R_1$: $o - u - o$.
28. $R_1 \longrightarrow L_2$: $u - o - u$.

29. $L_2 \longrightarrow R_1$: $u - o - u$.
30. $R_1 \longrightarrow L_1$: $o - u - o - 2u - 2o - u - o - u$.

HALF-CYCLE										
2	36	74	32	66	24	62	16	54	12	46
22	56	14	52	6	44	2	36	74	32	66
42	76	34	72	26	64	22	56	14	52	6
62	16	54	12	46	4	42	76	34	72	26
	U	O	O	U	U	O	O	U	U	O

HALF-CYCLE										
4	42	76	34	72	26	64	22	56	14	52
24	62	16	54	12	46	4	42	76	34	72
44	2	36	74	32	66	24	62	16	54	12
64	22	56	14	52	6	44	2	36	74	32
	U	U	U	O	O	U	U	O	O	U

HALF-CYCLE										
12	46	4	42	76	34	72	26	64	22	56
32	66	24	62	16	54	12	46	4	42	76
52	6	44	2	36	74	32	66	24	62	16
72	26	64	22	56	14	52	6	44	2	36
	U	U	U	O	O	U	U	O	O	U

HALF-CYCLE										
14	52	6	44	2	36	74	32	66	24	62
34	72	26	64	22	56	14	52	6	44	2
54	12	46	4	42	76	34	72	26	64	22
74	32	66	24	62	16	54	12	46	4	42
	U	O	O	U	U	O	O	U	U	O

HALF-CYCLE										
6	40	78	36	70	28	66	20	58	16	50
26	60	18	56	10	48	8	40	78	36	70
46	80	38	76	30	68	28	60	18	56	10
66	20	58	16	50	8	48	80	38	76	30
	U	O	O	U	U	O	O	U	U	U

HALF-CYCLE										
8	46	80	38	76	30	68	26	60	18	56
28	66	20	58	16	50	8	46	80	38	76
48	6	40	78	36	70	28	66	20	58	16
68	26	60	18	56	10	48	6	40	78	36
	O	U	U	O	O	U	U	O	O	U

HALF-CYCLE										
16	50	8	46	80	38	76	30	68	26	60
36	70	28	66	20	58	16	50	8	46	80
56	10	48	6	40	78	36	70	28	66	20
76	30	68	26	60	18	56	10	48	6	40
	O	U	U	O	O	U	U	O	O	U

HALF-CYCLE										
18	56	10	48	6	40	78	36	70	28	66
38	76	30	68	26	60	18	56	10	48	6
58	16	50	8	46	80	38	76	30	68	26
78	36	70	28	66	20	58	16	50	8	46
	U	O	O	U	U	O	O	U	U	U

HALF-CYCLE																									
10	48	6	40	78	36	70	28	66	20	58	16	46	76	26	56	6	44	2	36	74	32	66	24	62	16	54
30	68	26	60	18	56	10	48	6	40	78	36	66	16	46	76	26	64	22	56	14	52	6	44	2	36	74
50	8	46	80	38	76	30	68	26	60	18	56	6	36	66	16	46	4	42	76	34	72	26	64	22	56	14
70	28	66	20	58	16	50	8	46	80	38	76	26	56	6	36	66	24	62	16	54	12	46	4	42	76	34
	U	O	O	U	U	O	O	U	U	U	O	U	U	O	O	O	U	O	O	U	U	O	O	U	U	O

HALF-CYCLE																									
20	58	16	50	8	46	80	38	76	30	68	26	56	6	36	66	16	54	12	46	4	42	76	34	72	26	64
40	78	36	70	28	66	20	58	16	50	8	46	76	26	56	6	36	74	32	66	24	62	16	54	12	46	4
60	18	56	10	48	6	40	78	36	70	28	66	16	46	76	26	56	14	52	6	44	2	36	74	32	66	24
80	38	76	30	68	26	60	18	56	10	48	6	36	66	16	46	76	34	72	26	64	22	56	14	52	6	44
	O	U	U	O	O	U	U	O	O	U	O	O	O	U	U	O	U	U	U	O	O	U	U	O	O	U

Fig. 1055 — Tables for the even-numbered half-cycles.

31. $L_1 \longrightarrow R_2$: $o - u - o - u$.
32. $R_2 \longrightarrow L_1$: $u - o - u - o$.
33. $L_1 \longrightarrow R_2$: $u - o - u - o$.

34. $R_2 \longrightarrow L_1$: $o - u - o - u - o$.
35. $L_1 \longrightarrow R_2$: $o - u - o - u - 2o - u - o - u - o - u$.
36. $R_2 \longrightarrow L_1$: $u - o - u - o$.
37. $L_1 \longrightarrow R_1$: $u - o - u - o$.
38. $R_1 \longrightarrow L_2$: $o - u - o - 2u$.
39. $L_2 \longrightarrow R_1$: $o - u - o - u - o$.
40. $R_1 \longrightarrow L_1$: $u - o - u - o - u - o - u - o - u - o - u - o - u$.
41. $L_1 \longrightarrow R_2$: $u - o - u - 2o$.
42. $R_2 \longrightarrow L_1$: $o - u - o - u - o$.
43. $L_1 \longrightarrow R_2$: $o - u - o - u - o$.
44. $R_2 \longrightarrow L_1$: $2u - o - u - o - u$.
45. $L_1 \longrightarrow R_2$: $2u - o - u - 2o - u - o - 2u - o - u - o - u$.
46. $R_2 \longrightarrow L_1$: $o - u - o - 2u$.
47. $L_1 \longrightarrow R_1$: $o - u - o - u - o$.
48. $R_1 \longrightarrow L_2$: $o - u - o - u - o - u$.
49. $L_2 \longrightarrow R_1$: $o - u - o - u - o - u$.
50. $R_1 \longrightarrow L_1$: $u - o - u - o - 4u - 2o - u - o - u - o - u - o$.
51. $L_1 \longrightarrow R_2$: $2o - u - o - u - o$.
52. $R_2 \longrightarrow L_1$: $3u - o - u - o - u$.
53. $L_1 \longrightarrow R_2$: $2u - 2o - u - 2o$.
54. $R_2 \longrightarrow L_1$: $u - 2o - u - o - u - o$.
55. $L_1 \longrightarrow R_2$: $2o - 2u - o - u - o - u - o - 2u - 2o - u - o - u - o$.
56. $R_2 \longrightarrow L_1$: $o - 2u - o - u - o - u$.
57. $L_1 \longrightarrow R_1$: $o - u - 2o - u - o - u$.
58. $R_1 \longrightarrow L_2$: $u - 2o - u - o - 2u$.
59. $L_2 \longrightarrow R_1$: $2o - 2u - o - u - o$.
60. $R_1 \longrightarrow L_1$: $o - 2u - 2o - u - o - u - 2o - u - o - 3u - 2o - u - o - u$.
61. $L_1 \longrightarrow R_2$: $2u - 2o - 2u - 2o$.
62. $R_2 \longrightarrow L_1$: $u - 2o - 2u - o - u - o$.
63. $L_1 \longrightarrow R_2$: $2o - 2u - 2o - u - o$.
64. $R_2 \longrightarrow L_1$: $3u - 2o - 2u - o - u$.
65. $L_1 \longrightarrow R_2$: $2u - 2o - 2u - 4o - u - o - u - o - u - 2o - 2u - o - u$.
66. $R_2 \longrightarrow L_1$: $u - 2o - 2u - o - 2u$.
67. $L_1 \longrightarrow R_1$: $2o - 2u - 2o - u - o$.
68. $R_1 \longrightarrow L_2$: $o - 2u - 2o - 2u - o - u$.
69. $L_2 \longrightarrow R_1$: $o - u - 2o - 2u - 2o - u$.
70. $R_1 \longrightarrow L_1$: $u - 2o - 2u - 2o - 4u - 3o - u - 2o - 2u - 2o - u - o$.
71. $L_1 \longrightarrow R_2$: $2o - 2u - 2o - 2u - o$.
72. $R_2 \longrightarrow L_1$: $3u - 2o - 2u - 2o - u$.
73. $L_1 \longrightarrow R_2$: $2u - 2o - 2u - 2o - u - o$.
74. $R_2 \longrightarrow L_1$: $u - 2o - 2u - 2o - 2u - o$.
75. $L_1 \longrightarrow R_2$: $2o - 2u - 2o - 2u - 2o - u - 2o - 2u - 2o - 2u - 2o - 2u - o$.
76. $R_2 \longrightarrow L_1$: $o - 2u - 2o - 2u - 2o - u$.
77. $L_1 \longrightarrow R_1$: $o - u - 2o - 2u - 2o - 2u$.
78. $R_1 \longrightarrow L_2$: $u - 2o - 2u - 2o - 3u$.
79. $L_2 \longrightarrow R_1$: $2o - 2u - 2o - 2u - 2o$.
80. $R_1 \longrightarrow L_1$: $o - 2u - 2o - 2u - 2o - u - 3o - 2u - o - 3u - 2o - 2u - 2o - u$.

Euclid's algorithm, the path formula, the path in the RKT for each of the two interbraided Regular Knot components and their algorithm diagrams are shown in Fig. 1056.

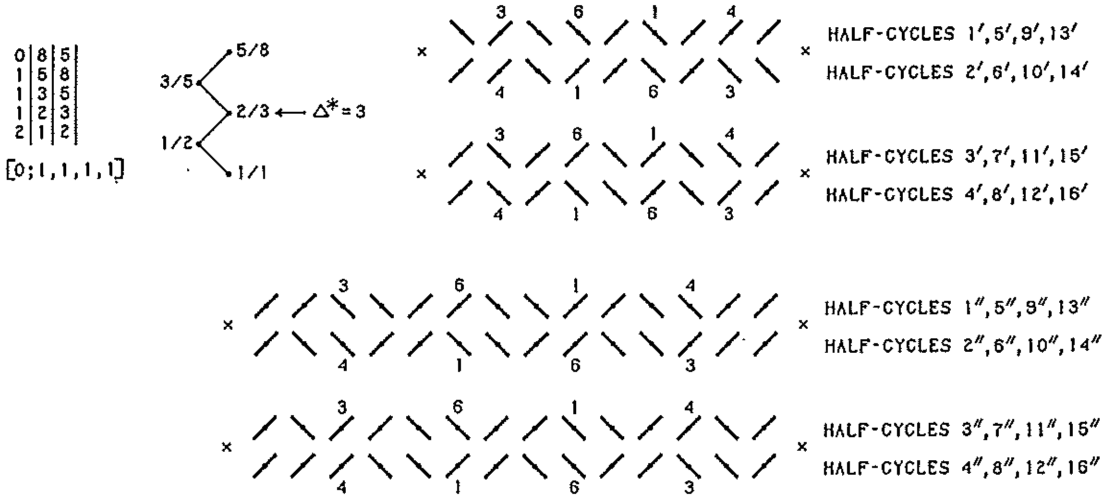

0 8 5
1 5 8
1 3 5
1 2 3
2 1 2
[0;1,1,1,1]
5/8
3/5
2/3 ← Δ* = 3
1/2
1/1
HALF-CYCLES 1′,5′,9′,13′
HALF-CYCLES 2′,6′,10′,14′
HALF-CYCLES 3′,7′,11′,15′
HALF-CYCLES 4′,8′,12′,16′
HALF-CYCLES 1″,5″,9″,13″
HALF-CYCLES 2″,6″,10″,14″
HALF-CYCLES 3″,7″,11″,15″
HALF-CYCLES 4″,8″,12″,16″
3 6 1 4
4 1 6 3

Fig. 1056 — Euclid's algorithm, path formula, path in RKT and algorithm diagrams for interbraided Regular Knots.

For the half-cycles $1'$-$16'$ of the interbraided Regular Knot component between the bight-boundaries R_2 and L_2 we read the following half-cycle braiding algorithms from its algorithm diagram:

$1'$. : $2u - 3o$.
$2'$. $(i = 0)$: $o - 2u - o - u$.
$3'$. $(i = 0)$: $2o - 2u - o$.
$4'$. $(i \leq 1)$: $u - 3o - 2u$.
$5'$. $(i \leq 1)$: $2u - o - u - 2o$.
$6'$. $(i \leq 2)$: $o - 3u - o - u$.
$7'$. $(i \leq 2)$: $2o - u - o - u - o$.
$8'$. $(i \leq 3)$: $2u - 3o - 2u$.
$9'$. $(i \leq 3)$: $u - o - u - o - u - 2o$.
$10'$. $(i \leq 4)$: $2o - 3u - o - 2u$.
$11'$. $(i \leq 4)$: $o - u - o - u - o - 2u - o$.
$12'$. $(i \leq 5)$: $2u - 3o - u - o - u$.
$13'$. $(i \leq 5)$: $u - o - u - o - u - 3o$.
$14'$. $(i \leq 6)$: $2o - u - o - 2u - o - 2u$.
$15'$. $(i \leq 6)$: $o - u - 2o - u - o - 2u - o$.
$16'$. $(i \leq 7)$: $2u - o - u - 2o - u - o - u$.

For the half-cycles $1''$-$16''$ of the interbraided Regular Knot component between the bight-boundaries R_2 and L_2 we read the following half-cycle braiding algorithms from its algorithm diagram:

$1''$. : $2o - u - o - 2u - o - u - 2o$.
$2''$. $(i = 0)$: $2u - 2o - u - o - 2u - o - u$.
$3''$. $(i = 0)$: $o - u - o - u - 2o - u - o - u - o$.
$4''$. $(i \leq 1)$: $u - o - 2u - o - 2u - 2o - 2u$.
$5''$. $(i \leq 1)$: $2o - u - o - 2u - 2o - u - 2o$.
$6''$. $(i \leq 2)$: $2u - 2o - u - 2o - 2u - o - u$.
$7''$. $(i \leq 2)$: $o - u - o - u - 2o - 2u - o - u - o$.
$8''$. $(i \leq 3)$: $u - 2o - 2u - o - 2u - 2o - 2u$.

$9''$. $(i \leq 3)$: $2o - 2u - o - 2u - 2o - u - 2o$.
$10''$. $(i \leq 4)$: $3u - 2o - u - 2o - 2u - 2o - u$.
$11''$. $(i \leq 4)$: $o - u - 2o - u - 2o - 2u - 2o - u - o$.
$12''$. $(i \leq 5)$: $u - 2o - 2u - o - 2u - 2o - 3u$.
$13''$. $(i \leq 5)$: $2o - 2u - o - 2u - 2o - 2u - 2o$.
$14''$. $(i \leq 6)$: $3u - 2o - 2u - 2o - 2u - 2o - u$.
$15''$. $(i \leq 6)$: $o - u - 2o - 2u - 2o - 2u - 2o - u - o$.
$16''$. $(i \leq 7)$: $u - 2o - 2u - 2o - 2u - 2o - 3u$.

Example 2.

Let Fig. 1057 depict the first-return string-run in the foundation knot. Let the bights on L_1 occupy all the apexes of the regular nested bights with $A = 3$ and let the bights on R_4 and L_4 be string-run wise in line with each other so that their positions are also the positions of the bights of the interbraid between the bight-boundaries R_4 and L_4.

Note that the central apex of each nest is empty but since in the general layout of the first-return string-run the distance between the bight-boundaries L_1 and L_3, respectively between the bight-boundaries R_1 and R_3, does take the position of L_2, respectively R_2, into account, their associated half-cycles must also be accounted for.

Hence the repeat-period of identical string-run half-cycle types is 3. Consequently $|C_1|_3 \neq 0$, while $|2C_1 + C_2 + 2C_3 + 8|_3 = 0$. Furthermore $|C_1 + C_3 + 4|_3 = 0$. We have the identical bight-index types $0 + 3n$ on bight-boundary L_1 and with $C_1 = 7$ the identical bight-index types $|C_1|_3 + 3n = |7|_3 + 3n = 1 + 3n$ on bight-boundary L_3. We have the identical bight-index types $0 + 3n$ on bight-boundary R_4 and with $C_3 = 7$ we have the identical bight-index types $|C_1 + C_3 + 4|_3 + 3n = |18|_3 + 3n = 0 + 3n$ on bight-boundary L_4. With $C_2 = 15$ we have $|2C_1 + C_2 + 2C_3 + 8|_3 = |51|_3 = 0$.

Since the bights on the bight-boundaries R_4 and L_4 are string-run wise in line with each other, $2C_1 + C_2 + 2C_3 + 8 = 14 + 15 + 14 + 8 = 51 = \beta'$ associated with circumferential bight-boundaries L_1, L_2 and L_3, and hence with $\alpha' = 3$. $\beta = \dfrac{\beta' \cdot \alpha}{\alpha'}$, hence with $\alpha = 3$ and $\alpha' = 3$, we obtain $\beta = \dfrac{51 \times 3}{3} = 51$. We thus obtain for $\dfrac{\beta}{\alpha} = \dfrac{\beta'}{\alpha'}$ the value $\dfrac{51}{3} = 17$. Thus for $\lambda = 1$, $\dfrac{{B_c}'}{\alpha'} = \dfrac{{B_c}'}{3}$ associated with the bight-boundaries L_1, L_2 and L_3 must be coprime with 17. $\dfrac{{B_c}'}{3} = 8$ and hence ${B_c}' = 3 \times 8 = 24$ on bight-boundaries L_1, L_2 and L_3 fulfils this condition.

Note that this foundation knot has $B_c = 8 \times \alpha = 8 \times 3 = 24$ bights.

The foundation knot has in fact regular nests, each with two bights and hence in the general layout of its first return string-run L_3 becomes L_2, R_4 becomes R_3, L_4 becomes L_3 and R_3 becomes R_2. The column distance between L_1 and L_2 becomes 2 as does the column distance between R_1 and R_2. The repeat-period becomes 2 and hence $|C_1|_2 \neq 0$, while $|2C_1 + C_2 + 2C_3 + 4|_2 = 0$ ($2C_1 + C_2 + 2C_3 + 4$ replaces $2C_1 + C_2 + 2C_3 + 8$). Furthermore $|C_1 + C_3 + 2|_2 = 0$ ($C_1 + C_3 + 2$ replaces $C_1 + C_3 + 4$). We have the identical bight-index types $0 + 2n$ on bight-boundary L_1 and with $C_1 = 5$ ($C_1 = 5$ replaces $C_1 = 7$) the identical bight-index types $|C_1|_2 + 2n = |5|_2 + 2n = 1 + 2n$ on bight-boundary L_2. We have the identical bight-index types $0 + 2n$ on bight-boundary R_3 and with $C_3 = 5$ ($C_3 = 5$ replaces $C_3 = 7$) we have the identical bight-index types $|C_1 + C_3 + 2|_2 + 2n = |12|_2 + 2n = 0 + 2n$ on bight-boundary L_3.

With $C_2 = 10$ ($C_2 = 10$ replaces $C_2 = 15$) we have $|2C_1 + C_2 + 2C_3 + 4|_2 = |34|_2 = 0$.

Since the bights on the bight-boundaries R_3 and L_3 are string-run wise in line with each other, $2C_1 + C_2 + 2C_3 + 4 = 10 + 10 + 10 + 4 = 34 = \beta'$ associated with circumferential bight-boundaries L_1 and L_2, hence with $\alpha' = 2$. $\beta = \frac{\beta' \cdot \alpha}{\alpha'}$, hence with $\alpha = 3$ and $\alpha' = 2$, we obtain $\beta = \frac{34 \times 3}{2} = 51$. We thus obtain for $\frac{\beta}{\alpha} = \frac{\beta'}{\alpha'}$ the value $\frac{51}{3} = \frac{34}{2} = 17$. Thus for $\lambda = 1$, $\frac{B_c{}'}{\alpha'} = \frac{B_c{}'}{2}$ associated with the bight-boundaries L_1 and L_2 must be coprime with 17. $\frac{B_c{}'}{2} = 8$ and hence $B_c{}' = 2 \times 8 = 16$ associated with the bight-boundaries L_1 and L_2 fulfils this condition. This foundation knot has $B_c = 8 \times \alpha = 8 \times 3 = 24$ bights as we have seen already.

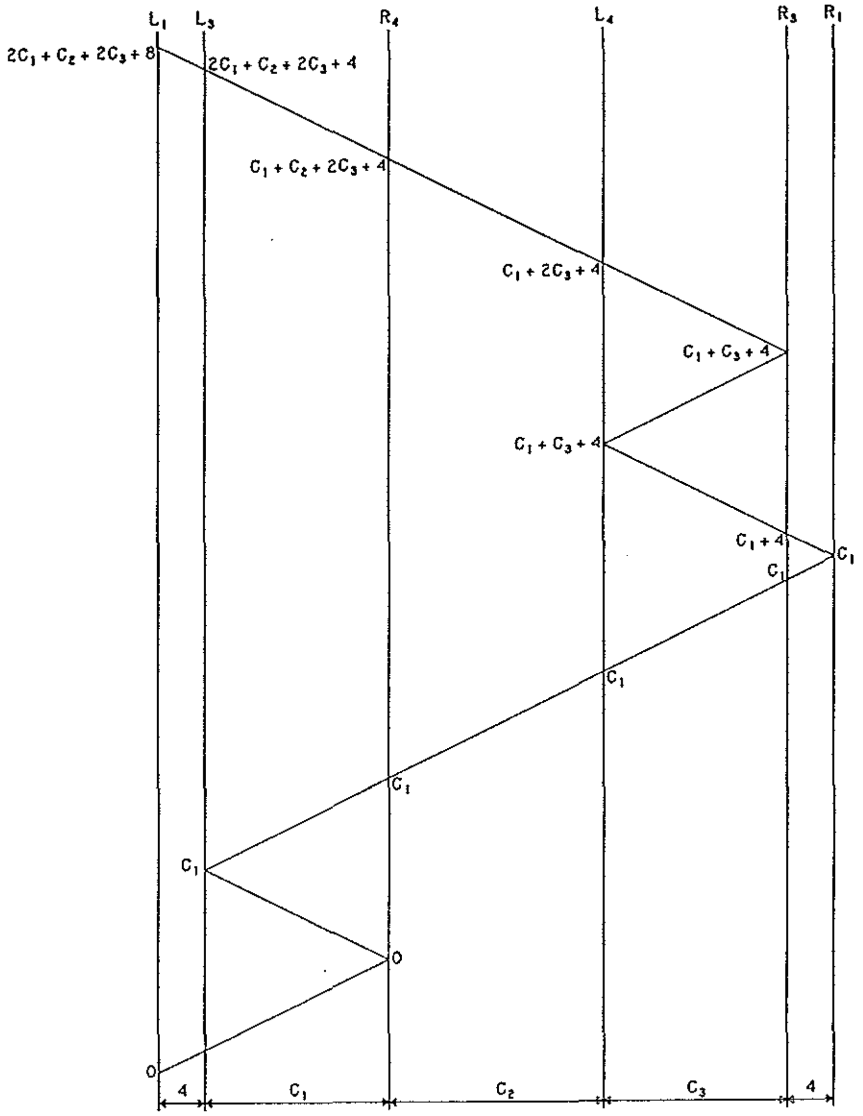


Fig. 1057 — The first-return string-run of the foundation knot.

Halfway between the bight-boundaries L_1 and L_3, respectively R_1 and R_3 we have bight-boundary L_2, respectively R_2. Consequently with the repeat-period of 3, the interbraided knot between the bight-boundaries L_2 and R_2 has eight bights and $\frac{2 + C_1 + C_2 + C_3 + 2}{3} = \frac{2 + 7 + 15 + 7 + 2}{3} = 11$ parts, hence it is a Regular Knot since g.c.d.(p, b) = g.c.d.$(11, 8) = 1$.

Another Regular Knot, hence with g.c.d.$(p, b) = 1$, will be interbraided between the bight-boundaries R_4 and L_4. This Regular Knot will have eight bights and $\frac{C_2}{3} = \frac{15}{3} = 5$ parts.

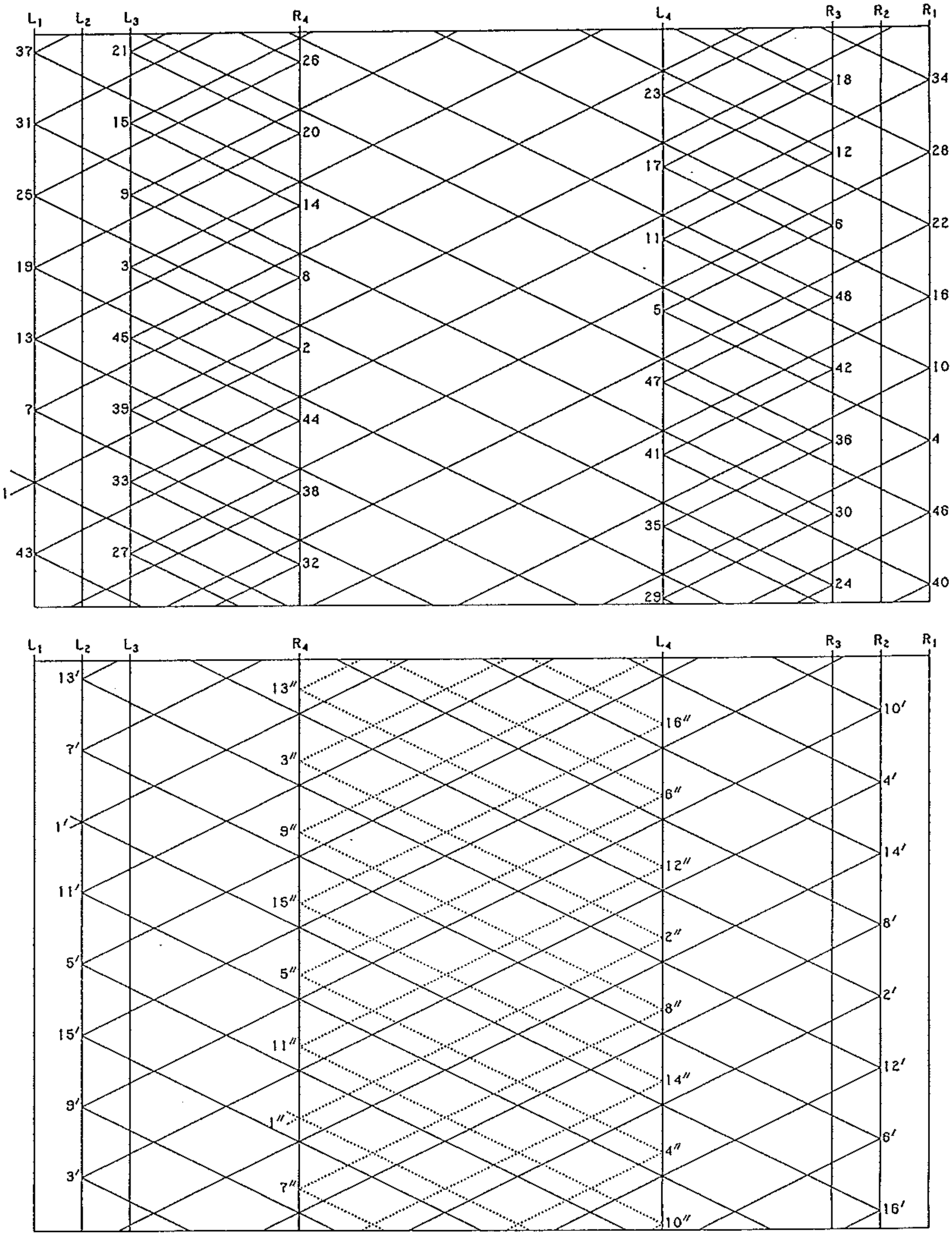


Fig. 1058 — The string-runs of the foundation knot and the interbraided Regular Knots.

In Fig. 1058 the upper diagram depicts the string-run of the foundation knot while in the lower diagram are depicted the string-run of the interbraided Regular Knot between the bight-boundaries L_2 and R_2 as well as the string-run of the interbraided Regular Knot between the bight-boundaries R_4 and L_4.

On the overall string-run of the Interbraided Cylindrical Braid so obtained, we can then superimpose a suitable coding. Such a superimposed coding on this overall string-run is shown in Fig. 1059.

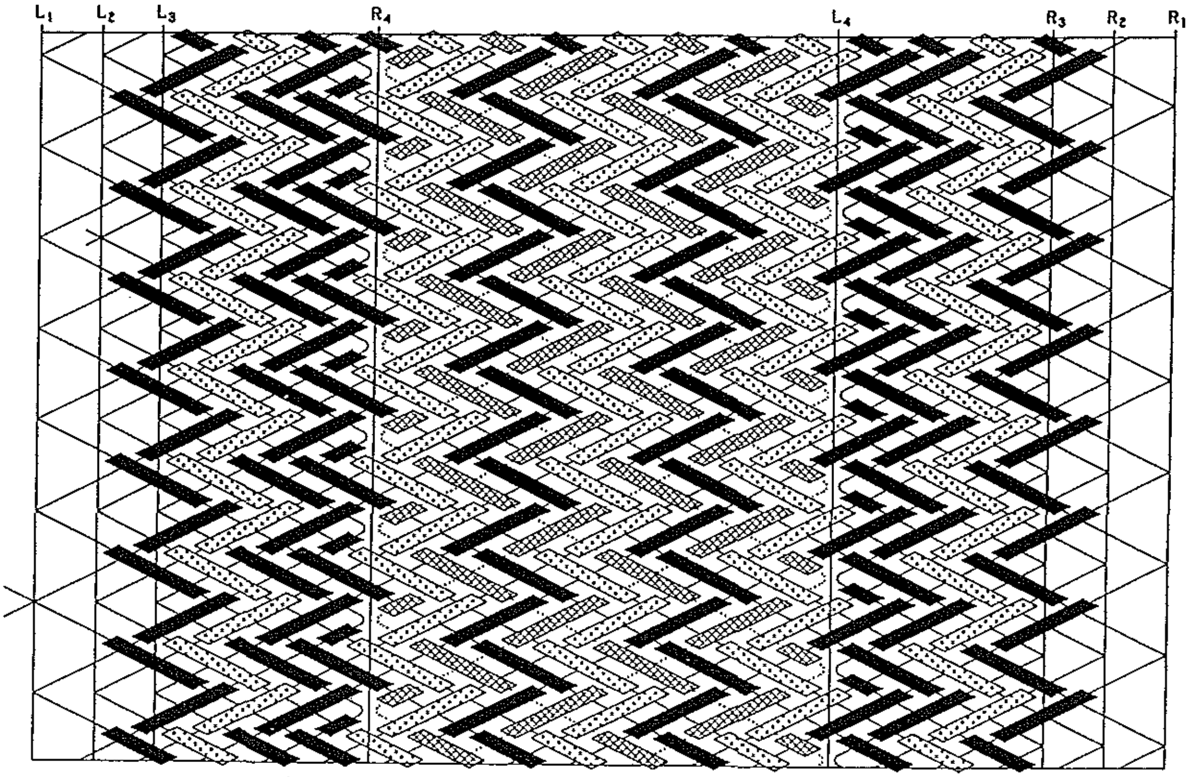


Fig. 1059 — The grid-diagram of the Interbraided Cylindrical Braid.

The half-cycle braiding algorithms for the foundation knot can be read from the tables in Fig. 1060 and Fig. 1061 as follows:

1. $L_1 \longrightarrow R_4$: Free run.
2. $R_4 \longrightarrow L_3$: Free run.
3. $L_3 \longrightarrow R_1$: Free run.
4. $R_1 \longrightarrow L_4$: Free run.
5. $L_4 \longrightarrow R_3$: Free run.
6. $R_3 \longrightarrow L_1$: $u - o$.
7. $L_1 \longrightarrow R_4$: u.
8. $R_4 \longrightarrow L_3$: o.
9. $L_3 \longrightarrow R_1$: $u - o$.
10. $R_1 \longrightarrow L_4$: u.
11. $L_4 \longrightarrow R_3$: o.
12. $R_3 \longrightarrow L_1$: $o - 2u - o$.
13. $L_1 \longrightarrow R_4$: $o - u$.
14. $R_4 \longrightarrow L_3$: $u - o$.
15. $L_3 \longrightarrow R_1$: $o - 2u - o$.
16. $R_1 \longrightarrow L_4$: $o - u$.
17. $L_4 \longrightarrow R_3$: $u - o$.

18. $R_3 \longrightarrow L_1$: $u - o - u - o - u - o$.
19. $L_1 \longrightarrow R_4$: $o - u$.
20. $R_4 \longrightarrow L_3$: $u - o$.
21. $L_3 \longrightarrow R_1$: $u - o - u - o - u - o$.
22. $R_1 \longrightarrow L_4$: $o - u$.
23. $L_4 \longrightarrow R_3$: $u - o$.
24. $R_3 \longrightarrow L_1$: $o - u - o - u - o - u - 2o$.

HALF-CYCLE					
1	7	39	13	45	19
7	13	45	19	3	25
13	19	3	25	9	31
19	25	9	31	15	37
25	31	15	37	21	43
31	37	21	43	27	✕
37	43	27	✕	33	7
43	✕	33	7	39	13
	U	O	O	U	U

HALF-CYCLE				
5	43	11	✕	17
11	✕	17	7	23
17	7	23	13	29
23	13	29	19	35
29	19	35	25	41
35	25	41	31	47
41	31	47	37	5
47	37	5	43	11
	U	O	O	U

HALF-CYCLE															
3	25	9	31	15	37	43	✕	7	13	19	35	25	41	31	47
9	31	15	37	21	43	✕	7	13	19	25	41	31	47	37	5
15	37	21	43	27	✕	7	13	19	25	31	47	37	5	43	11
21	43	27	✕	33	7	13	19	25	31	37	5	43	11	✕	17
27	✕	33	7	39	13	19	25	31	37	43	11	✕	17	7	23
33	7	39	13	45	19	25	31	37	43	✕	17	7	23	13	29
39	13	45	19	3	25	31	37	43	✕	7	23	13	29	19	35
45	19	3	25	9	31	37	43	✕	7	13	29	19	35	25	41
	U	U	O	O	U	O	U	O	U	O	O	U	U	O	O

Fig. 1060 — Tables for the odd-numbered half-cycles.

25. $L_1 \longrightarrow R_4$: $o - u$.
26. $R_4 \longrightarrow L_3$: $u - o$.
27. $L_3 \longrightarrow R_1$: $o - u - o - u - o - u - 2o$.
28. $R_1 \longrightarrow L_4$: $o - u$.
29. $L_4 \longrightarrow R_3$: $u - o$.
30. $R_3 \longrightarrow L_1$: $u - o - u - o - u - o - 2u - 2o$.
31. $L_1 \longrightarrow R_4$: $o - u$.
32. $R_4 \longrightarrow L_3$: $u - o$.
33. $L_3 \longrightarrow R_1$: $u - o - u - o - u - o - 2u - 2o$,.
34. $R_1 \longrightarrow L_4$: $o - 2u$.
35. $L_4 \longrightarrow R_3$: $u - o$.
36. $R_3 \longrightarrow L_1$: $u - o - u - o - u - 2o - 2u - 2o$.
37. $L_1 \longrightarrow R_4$: $o - 2u$.
38. $R_4 \longrightarrow L_3$: $u - o - u$.
39. $L_3 \longrightarrow R_1$: $u - 2o - u - o - u - 2o - 2u - 2o$.
40. $R_1 \longrightarrow L_4$: $2o - 2u$.
41. $L_4 \longrightarrow R_3$: $u - o - u$.
42. $R_3 \longrightarrow L_1$: $u - 2o - u - o - 2u - 2o - 2u - 2o$.

43. $L_1 \longrightarrow R_4$: $2o - 2u$.
44. $R_4 \longrightarrow L_3$: $u - 2o - u$.
45. $L_3 \longrightarrow R_1$: $2u - 2o - u - o - 2u - 2o - 2u - 2o$.

HALF-CYCLE				
2	40	8	46	14
8	46	14	4	20
14	4	20	10	26
20	10	26	16	32
26	16	32	22	38
32	22	38	28	44
38	28	44	34	2
44	34	2	40	8
	U	O	O	U

HALF-CYCLE					
4	10	42	16	48	22
10	16	48	22	6	28
16	22	6	28	12	34
22	28	12	34	18	40
28	34	18	40	24	46
34	40	24	46	30	4
40	46	30	4	36	10
46	4	36	10	42	16
	U	O	O	U	U

HALF-CYCLE															
6	28	12	34	18	40	46	4	10	16	22	38	28	44	34	2
12	34	18	40	24	46	4	10	16	22	28	44	34	2	40	8
18	40	24	46	30	4	10	16	22	28	34	2	40	8	46	14
24	46	30	2	36	10	16	22	28	34	40	8	46	14	4	20
30	4	36	8	42	16	22	28	34	40	46	14	4	20	10	26
36	10	42	14	48	22	28	34	40	46	4	20	10	26	16	32
42	16	48	20	6	28	34	40	46	4	10	26	16	32	22	38
48	22	6	26	12	34	40	46	4	10	16	32	22	38	28	44
	U	U	O	O	U	O	U	O	U	O	O	U	U	O	O

Fig. 1061 — Tables for the even-numbered half-cycles.

46. $R_1 \longrightarrow L_4$: $u - 2o - 2u$.
47. $L_4 \longrightarrow R_3$: $u - 2o - u$.
48. $R_3 \longrightarrow L_1$: $2u - 2o - u - o - u - o - u - 2o - 2u - 2o$.

Euclid's algorithm, the path formula, the path in the RKT and the algorithm diagram for the interbraided Regular Knot $p/b = 11/8$ between the bight-boundaries L_2 and R_2 and for the interbraided Regular Knot $p/b = 5/8$ between the bight-boundaries R_4 and L_4 are shown in Fig. 1062.

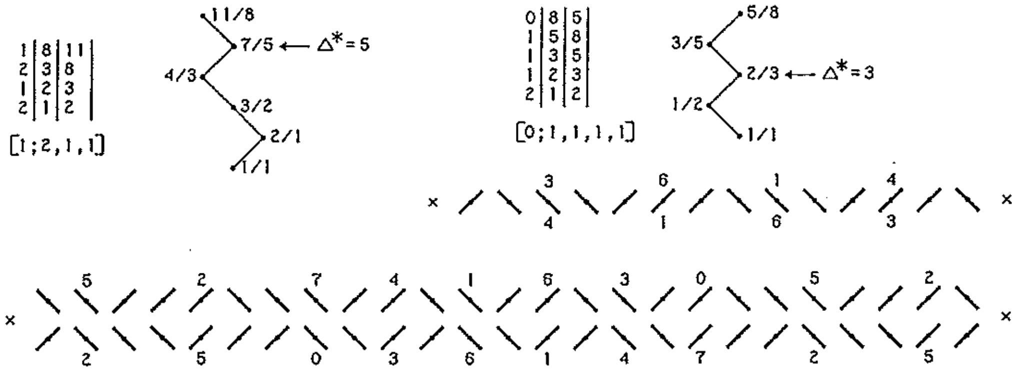


Fig. 1062 — Euclid's algorithm, path formula, path in RKT and algorithm diagrams for interbraided Regular Knots.

For the half-cycles 1′-16′ of the interbraided Regular Knot $p/b = 11/8$ between the bight-boundaries L_2 and R_2 we read the following half-cycle braiding algorithms from its algorithm diagram:

$1'$. : $u-2o-2u-o-u-o-u-o-2u-2o-u$.
$2'$. $(i=0)$: $u-2o-2u-o-u-o-u-2o-2u-2o-u$.
$3'$. $(i=0)$: $u-2o-2u-o-u-o-u-2o-2u-2o-u$.
$4'$. $(i\leq 1)$: $u-2o-2u-o-2u-o-u-2o-2u-2o-u$.
$5'$. $(i\leq 1)$: $u-2o-2u-o-2u-o-u-2o-2u-2o-u$.
$6'$. $(i\leq 2)$: $u-3o-2u-o-2u-o-u-2o-2u-3o-u$.
$7'$. $(i\leq 2)$: $u-3o-2u-o-2u-o-u-2o-2u-3o-u$.
$8'$. $(i\leq 3)$: $u-3o-2u-o-2u-o-2u-2o-2u-3o-u$.
$9'$. $(i\leq 3)$: $u-3o-2u-o-2u-o-2u-2o-2u-3o-u$.
$10'$. $(i\leq 4)$: $u-3o-2u-2o-2u-o-2u-2o-2u-3o-u$.
$11'$. $(i\leq 4)$: $u-3o-2u-2o-2u-o-2u-2o-2u-3o-u$.
$12'$. $(i\leq 5)$: $2u-3o-2u-2o-2u-o-2u-2o-3u-3o-u$.
$13'$. $(i\leq 5)$: $2u-3o-2u-2o-2u-o-2u-2o-3u-3o-u$.
$14'$. $(i\leq 6)$: $2u-3o-2u-2o-2u-2o-2u-2o-3u-3o-u$.
$15'$. $(i\leq 6)$: $2u-3o-2u-2o-2u-2o-2u-2o-3u-3o-u$.
$16'$. $(i\leq 7)$: $2u-3o-2u-2o-2u-2o-2u-2o-3u-3o-u$.

For the half-cycles $1''$-$16''$ of the interbraided Regular Knot $p/b=5/8$ between the bight-boundaries R_4 and L_4 we read the following half-cycle braiding algorithms from its algorithm diagram:

$1''$. : $o-2u-2o-2u-2o-u$.
$2''$. $(i=0)$: $o-2u-2o-2u-2o-u$.
$3''$. $(i=0)$: $o-2u-2o-2u-2o-u$.
$4''$. $(i\leq 1)$: $o-2u-2o-3u-2o-u$.
$5''$. $(i\leq 1)$: $o-2u-2o-3u-2o-u$.
$6''$. $(i\leq 2)$: $o-2u-2o-3u-2o-u$.
$7''$. $(i\leq 2)$: $o-2u-2o-3u-2o-u$.
$8''$. $(i\leq 3)$: $o-3u-2o-3u-2o-u$.
$9''$. $(i\leq 3)$: $o-3u-2o-3u-2o-u$.
$10''$. $(i\leq 4)$: $o-3u-2o-3u-3o-u$.
$11''$. $(i\leq 4)$: $o-3u-2o-3u-3o-u$.
$12''$. $(i\leq 5)$: $o-3u-2o-3u-3o-u$.
$13''$. $(i\leq 5)$: $o-3u-2o-3u-3o-u$.
$14''$. $(i\leq 6)$: $o-3u-3o-3u-3o-u$.
$15''$. $(i\leq 6)$: $o-3u-3o-3u-3o-u$.
$16''$. $(i\leq 7)$: $o-3u-3o-3u-3o-u$.

The foundation knots in the "new" type of Interbraided Cylindrical Braids contain in general not only a considerable length of string but require at the place of the interbraid(s) enough room for the accommodation of the interbraided component(s). They are therefore often more difficult to braid.

An example in which the essential string-run parameters are intimately associated with the coding will be discussed in the next Issue of *The Braider*. For the derivation of these parameters it is of some importance to draw a small section of the grid-diagram first. When the design of this section fulfils our requirement we can then derive from it the requirements for the parametric values of the string-run.

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Interbraided Cylindrical Braids 1323

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for
the braiding artisan

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Interbraided Cylindrical Braids

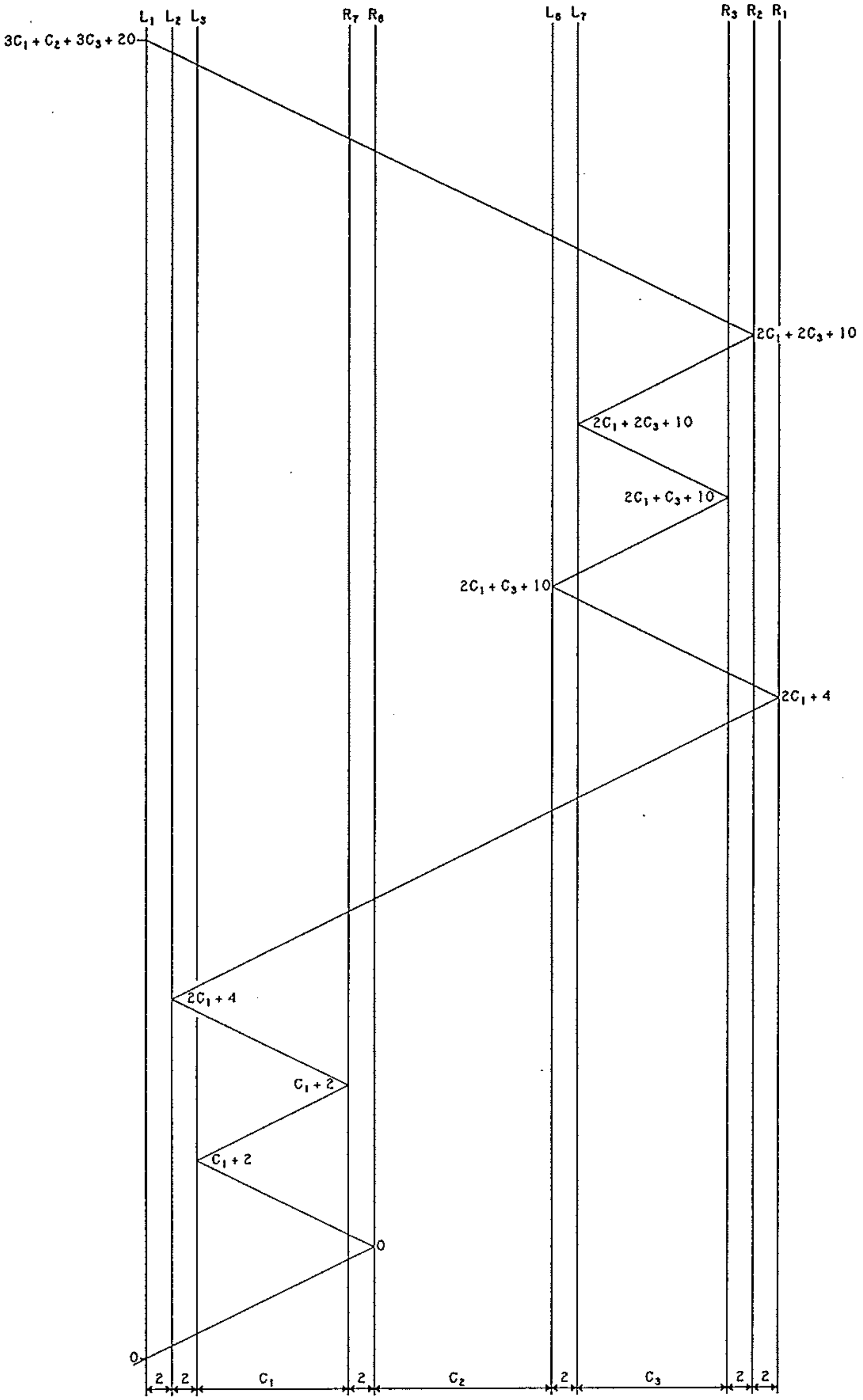

Fig. 1063 — The first-return string-run of the foundation knot.

As mentioned at the bottom of pg. 1322, we shall present here an Example of a "new" type Interbraided Cylindrical Braid in which the string-run parameters of the foundation knot are intimately associated with the coding of the Interbraided Cylindrical Braid.

Let Fig. 1063 depict the first-return string-run in the foundation knot. Let the bight-edge formed by the bight-boundaries L_1, L_2 and L_3 consist of regular nested bights and let its coding be a pineapple coding (see Fig. 1064). Similarly let the bight-edge formed by the bight-boundaries R_1, R_2 and R_3 consist of regular nested bights and let its coding be a pineapple coding (see Fig. 1064). Let the bights on the bight-edge formed by the bight-boundaries R_6 and R_7 form regular nests and let their associated coding be as shown in Fig. 1064. Similarly let the bights on the bight-edge formed by the bight-boundaries L_6 and L_7 form regular nests and let their associated coding be as shown in Fig. 1064. Let the apexes of the nests on bight-edge L_4, L_5 of the central interbraid be central to the apexes of the nests on bight-edge R_4, R_5 of the central interbraid (see Fig. 1064). Let in Fig. 1064 the crossings with the round dots depict the same crossing; hence the crossings with the square dots depict the same crossing. The upper diagram sections, in which the interbraid is shown, are thus the lower diagram sections in which the foundation knot is shown.

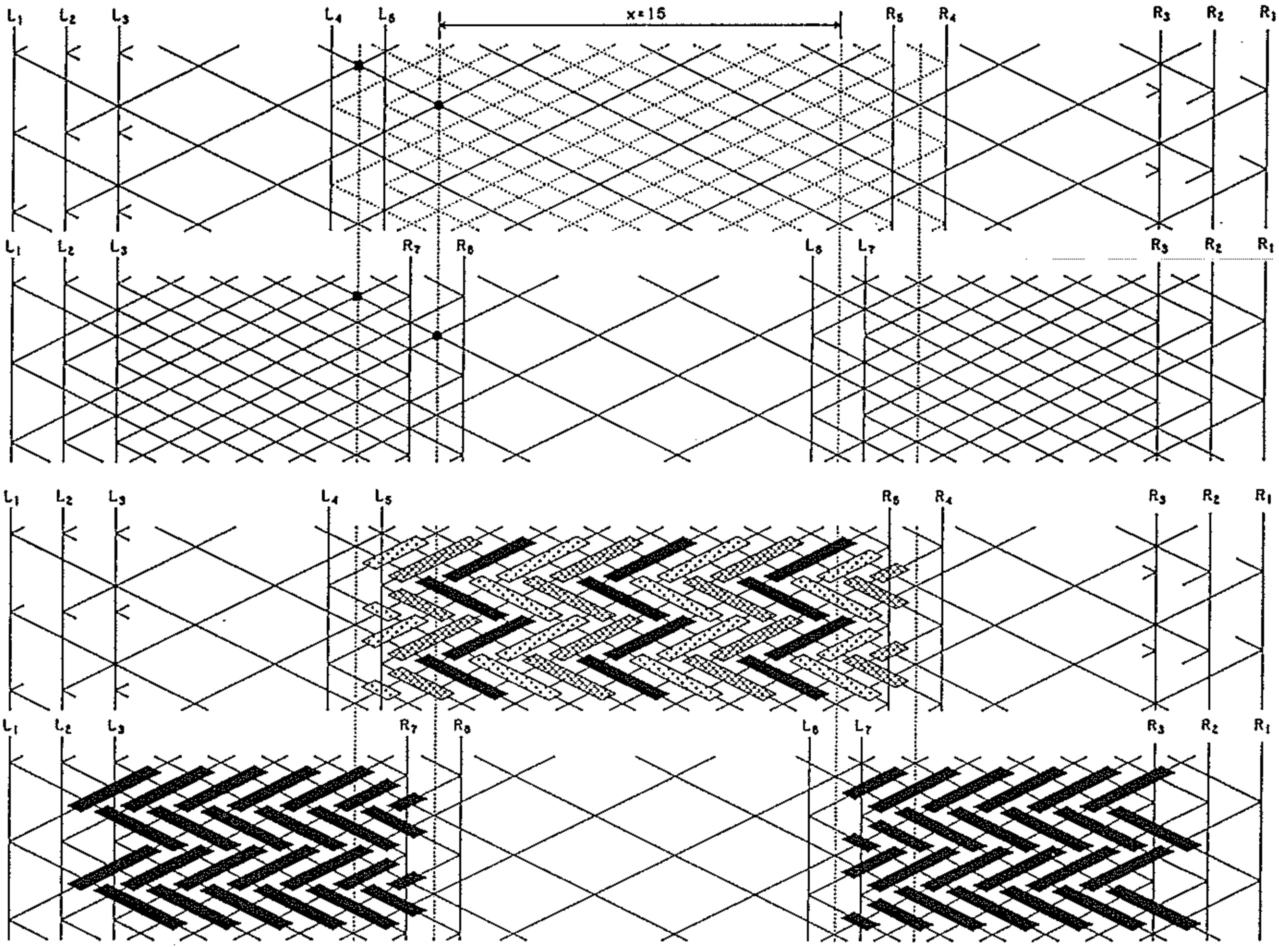

Fig. 1064 — Designing the Interbraided Cylindrical Braid.

Let the central interbraid have a left bight-edge formed by the bight-boundaries L_4 and L_5 and let the bights on this bight-edge form regular nests; let their associated coding be as shown in Fig. 1064. Similarly let the right bight-edge of the central interbraid be formed by the bight-boundaries R_4 and R_5 and let the bights on this bight-edge form regular nests; let their associated coding be as shown in Fig. 1064.

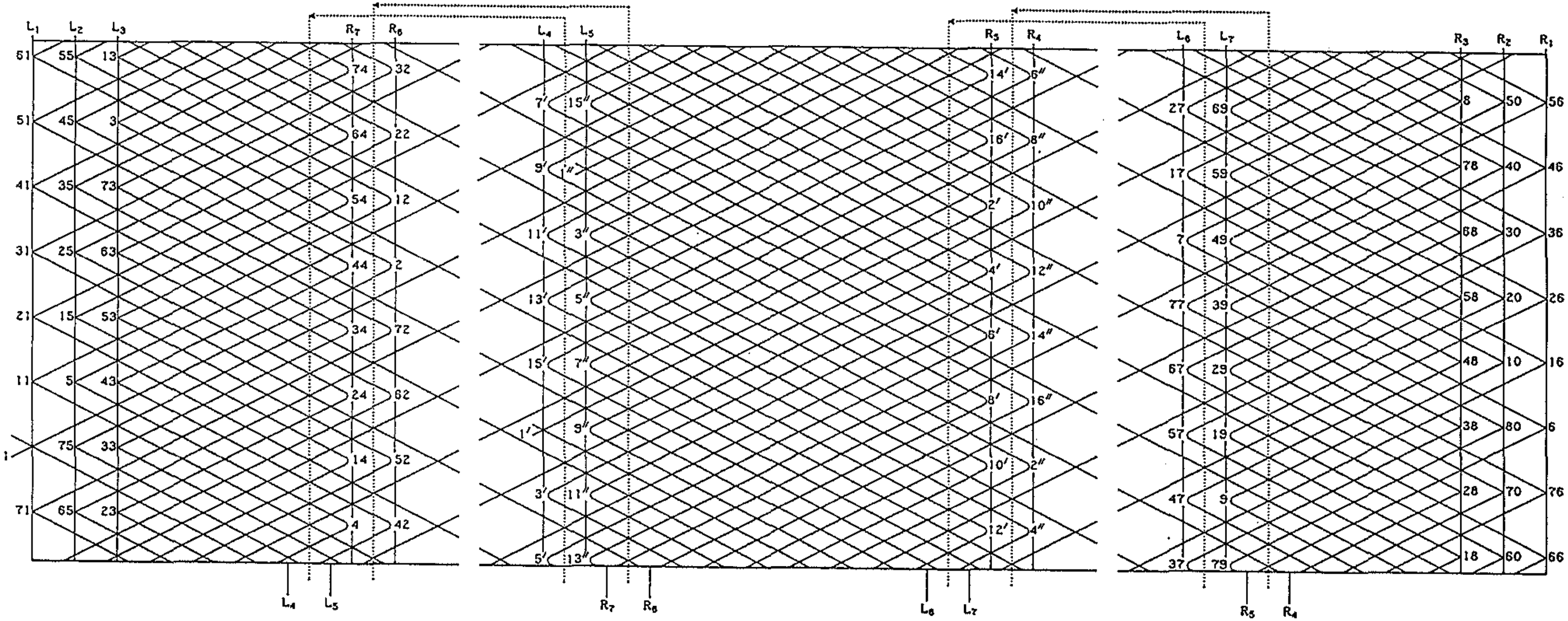

Fig. 1065 — The string-run of the Interbraided Cylindrical Braid.

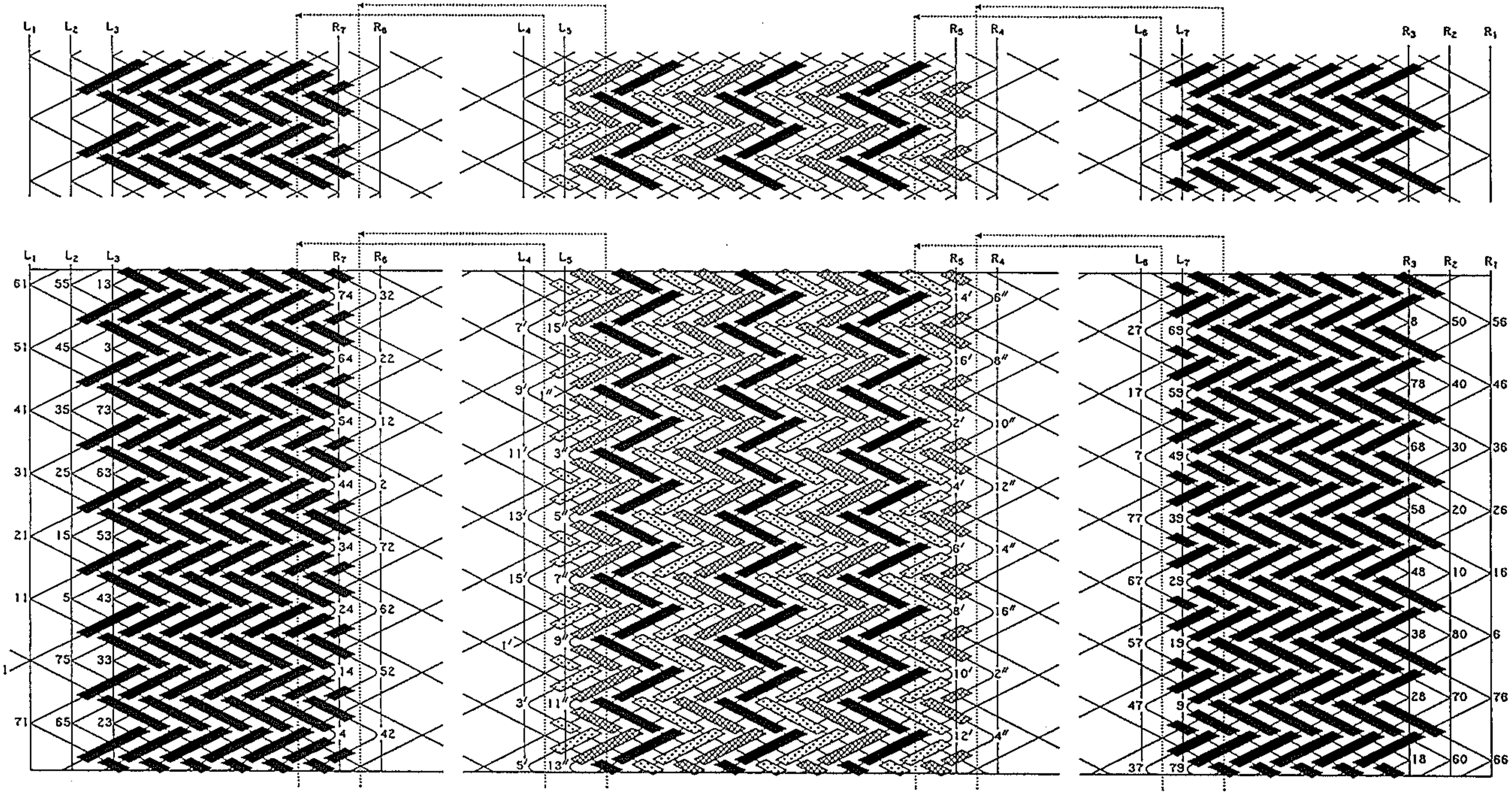

Fig. 1066 — The superimposed coding.

Note that the nests on the bight-edge formed by the bight-boundaries L_4, L_5 slot in between the nests on the bight-edge formed by the bight-boundaries R_6, R_7 so that bight-boundary L_4 lies 5 columns to the left of bight-boundary R_6, and similarly that the nests on the bight-edge formed by the bight-boundaries R_4, R_5 slot in between the nests on the bight-edge formed by the bight-boundaries L_6, L_7 so that bight-boundary R_4 lies 5 columns to the right of bight-boundary L_6.

Note that the codings associated with the bights on the bight-edges $L_4, L_5 — R_6, R_7$ and $R_4, R_5 — L_6, L_7$ cover the weave at these bight-edges.

We have now designed a small section of grid-diagram which contains the above listed requirements (see the upper grid-diagram section in Fig. 1066). From this section of grid-diagram (or from Fig. 1064) we see that $C_1 = C_3 = 11$ (column distance between L_3 and R_7, respectively between L_7 and R_3) and $C_2 = 13$ (column distance between R_6 and L_6) (see Fig. 1064 and Fig. 1065).

Hence $3C_1 + C_2 + 3C_3 + 20 = 33 + 13 + 33 + 20 = 99 = \beta'$ associated with the circumferencial bight-boundaries L_1, L_2, L_3 and hence with $\alpha' = 3$. $\beta = \dfrac{\beta' \cdot \alpha}{\alpha'}$, hence with $\alpha = 5$ and $\alpha' = 3$, we obtain $\beta = \dfrac{99 \times 5}{3} = 165$. We thus obtain for $\dfrac{\beta}{\alpha} = \dfrac{\beta'}{\alpha'}$ the value $\dfrac{165}{5} = \dfrac{99}{3} = 33$. Thus for $\lambda = 1$, $\dfrac{B_c{}'}{\alpha'} = \dfrac{B_c{}'}{3}$ on bight-boundaries L_1, L_2, L_3 must be coprime with 33. $\dfrac{B_c{}'}{3} = 8$ and hence $B_c{}' = 3 \times 8 = 24$ on bight-boundaries L_1, L_2, L_3 fulfils this condition.

Note that this foundation knot has $B_c = 8 \times \alpha = 8 \times 5 = 40$ bights.

The central section between the bight-edges L_4, L_5 and R_4, R_5 has thus a string-run similar to that of a Standard Regular Nested Cylindrical Braid with $A = 3$ and $x = C_2 + 2 = 13 + 2 = 15$. Consequently $2A + x - 2 = 6 + 15 - 2 = 19 = 2 \times 7 + 5$. Thus the interbraids between the bight-boundaries L_4 and R_5 respectively between the bight-boundaries L_5 and R_4 are Regular Knots with $p/b = 7/8$.

The half-cycle braiding algorithms for the foundation knot can be read from the tables in Fig. 1067 and Fig. 1068 as follows:

1. $L_1 \longrightarrow R_6$: Free run.
2. $R_6 \longrightarrow L_3$: Free run.
3. $L_3 \longrightarrow R_7$: Free run.
4. $R_7 \longrightarrow L_2$: u.
5. $L_2 \longrightarrow R_1$: u.
6. $R_1 \longrightarrow L_6$: Free run.
7. $L_6 \longrightarrow R_3$: Free run.
8. $R_3 \longrightarrow L_7$: u.
9. $L_7 \longrightarrow R_2$: u.
10. $R_2 \longrightarrow L_1$: $4u$.
11. $L_1 \longrightarrow R_6$: u.
12. $R_6 \longrightarrow L_3$: u.
13. $L_3 \longrightarrow R_7$: $2u$.
14. $R_7 \longrightarrow L_2$: $o - 2u$.
15. $L_2 \longrightarrow R_1$: $o - 4u$.
16. $R_1 \longrightarrow L_6$: u.

17. $L_6 \longrightarrow R_3 :\ u\,.$
18. $R_3 \longrightarrow L_7 :\ o - 2u\,.$
19. $L_7 \longrightarrow R_2 :\ o - 2u\,.$
20. $R_2 \longrightarrow L_1 :\ o - u - o - 2u - 2o - u\,.$

HALF-CYCLE													
1	11	5	43	21	15	53	31	25	63	41	35	73	51
11	21	15	53	31	25	63	41	35	73	51	45	3	61
21	31	25	63	41	35	73	51	45	3	61	55	13	71
31	41	35	73	51	45	3	61	55	13	71	65	23	☒
41	51	45	3	61	55	13	71	65	23	☒	75	33	11
51	61	55	13	71	65	23	☒	75	33	11	5	43	21
61	71	65	23	☒	75	33	11	5	43	21	15	53	31
71	☒	75	33	11	5	43	21	15	53	31	25	63	41
	O	O	O	U	U	U	O	O	O	U	U	U	O

HALF-CYCLE										
3	61	55	13	71	65	23	☒	75	33	11
13	71	65	23	☒	75	33	11	5	43	21
23	☒	75	33	11	5	43	21	15	53	31
33	11	5	43	21	15	53	31	25	63	41
43	21	15	53	31	25	63	41	35	73	51
53	31	25	63	41	35	73	51	45	3	61
63	41	35	73	51	45	3	61	55	13	71
73	51	45	3	61	55	13	71	65	23	☒
	U	U	O	O	O	U	U	U	O	O

HALF-CYCLE											
7	11	17	59	21	27	69	31	37	79	41	47
17	21	27	69	31	37	79	41	47	9	51	57
27	31	37	79	41	47	9	51	57	19	61	67
37	41	47	9	51	57	19	61	67	29	71	77
47	51	57	19	61	67	29	71	77	39	☒	7
57	61	67	29	71	77	39	☒	7	49	11	17
67	71	77	39	☒	7	49	11	17	59	21	27
77	☒	7	49	11	17	59	21	27	69	31	37
	O	O	U	U	U	O	O	O	U	U	U

HALF-CYCLE											
9	51	57	19	61	67	29	71	77	39	☒	7
19	61	67	29	71	77	39	☒	7	49	11	17
29	71	77	39	☒	7	49	11	17	59	21	27
39	☒	7	49	11	17	59	21	27	69	31	37
49	11	17	59	21	27	69	31	37	79	41	47
59	21	27	69	31	37	79	41	47	9	51	57
69	31	37	79	41	47	9	51	57	19	61	67
79	41	47	9	51	57	19	61	67	29	71	77
	O	O	O	U	U	U	O	O	O	U	U

HALF-CYCLE																															
5	21	15	53	31	25	63	41	35	73	51	45	3	61	71	☒	11	21	31	37	79	41	47	9	51	57	19	61	67	29	71	77
15	31	25	63	41	35	73	51	45	3	61	55	13	71	☒	11	21	31	41	47	9	51	57	19	61	67	29	71	77	39	☒	7
25	41	35	73	51	45	3	61	55	13	71	65	23	☒	11	21	31	41	51	57	19	61	67	29	71	77	39	☒	7	49	11	17
35	51	45	3	61	55	13	71	65	23	☒	75	33	11	21	31	41	51	61	67	29	71	77	39	☒	7	49	11	17	59	21	27
45	61	55	13	71	65	23	☒	75	33	11	5	43	21	31	41	51	61	71	77	39	☒	7	49	11	17	59	21	27	69	31	37
55	71	65	23	☒	75	33	11	5	43	21	15	53	31	41	51	61	71	☒	7	49	11	17	59	21	27	69	31	37	79	41	47
65	☒	75	33	11	5	43	21	15	53	31	25	63	41	51	61	71	☒	11	17	59	21	27	69	31	37	79	41	47	9	51	57
75	11	5	43	21	15	53	31	25	63	41	35	73	51	61	71	☒	11	21	27	69	31	37	79	41	47	9	51	57	19	61	67
	U	O	O	O	U	U	U	O	O	O	U	U	U	O	U	O	U	O	U	O	U	U	U	O	O	O	U	U	U	O	O	O	U

Fig. 1067 — Tables for the odd-numbered half-cycles.

21. $L_1 \longrightarrow R_6 :\ o - u\,.$
22. $R_6 \longrightarrow L_3 :\ o - u\,.$
23. $L_3 \longrightarrow R_7 :\ 2o - 2u\,.$
24. $R_7 \longrightarrow L_2 :\ u - 2o - 2u\,.$
25. $L_2 \longrightarrow R_1 :\ u - o - u - o - 2u - 2o - u\,.$
26. $R_1 \longrightarrow L_6 :\ o - u\,.$
27. $L_6 \longrightarrow R_3 :\ o - u\,.$
28. $R_3 \longrightarrow L_7 :\ u - 2o - 2u\,.$
29. $L_7 \longrightarrow R_2 :\ u - 2o - 2u\,.$
30. $R_2 \longrightarrow L_1 :\ u - o - 2u - o - 4u - 2o - u\,.$
31. $L_1 \longrightarrow R_6 :\ u - o - u\,.$
32. $R_6 \longrightarrow L_3 :\ u - o - u\,.$
33. $L_3 \longrightarrow R_7 :\ 2u - 2o - 2u\,.$

34. $R_7 \longrightarrow L_2$: $o - 2u - 2o - 2u$.
35. $L_2 \longrightarrow R_1$: $o - u - o - 2u - o - 4u - 2o - u$.
36. $R_1 \longrightarrow L_6$: $u - o - u - o$.
37. $L_6 \longrightarrow R_3$: $u - o - u$.
38. $R_3 \longrightarrow L_7$: $2u - 2o - 2u$.
39. $L_7 \longrightarrow R_2$: $o - 2u - 2o - 2u$.
40. $R_2 \longrightarrow L_1$: $o - u - 2o - 2u - o - 2u - 2o - 2u - 2o - u$.

HALF-CYCLE											
2	6	12	54	16	22	64	26	32	74	36	42
12	16	22	64	26	32	74	36	42	4	46	52
22	26	32	74	36	42	4	46	52	14	56	62
32	36	42	4	46	52	14	56	62	24	66	72
42	46	52	14	56	62	24	66	72	34	76	2
52	56	62	24	66	72	34	76	2	44	6	12
62	66	72	34	76	2	44	6	12	54	16	22
72	76	2	44	6	12	54	16	22	64	26	32
	O	O	U	U	U	O	O	O	U	U	U

HALF-CYCLE											
4	46	52	14	56	62	24	66	72	34	76	2
14	56	62	24	66	72	34	76	2	44	6	12
24	66	72	34	76	2	44	6	12	54	16	22
34	76	2	44	6	12	54	16	22	64	26	32
44	6	12	54	16	22	64	26	32	74	36	42
54	16	22	64	26	32	74	36	42	4	46	52
64	26	32	74	36	42	4	46	52	14	56	62
74	36	42	4	46	52	14	56	62	24	66	72
	O	O	O	U	U	U	O	O	O	U	U

HALF-CYCLE													
6	16	10	48	26	20	58	36	30	68	46	40	78	56
16	26	20	58	36	30	68	46	40	78	56	50	8	66
26	36	30	68	46	40	78	56	50	8	66	60	18	76
36	46	40	78	56	50	8	66	60	18	76	70	28	6
46	56	50	8	66	60	18	76	70	28	6	80	38	16
56	66	60	18	76	70	28	6	80	38	16	10	48	26
66	76	70	28	6	80	38	16	10	48	26	20	58	36
76	6	80	38	16	10	48	26	20	58	36	30	68	46
	O	O	O	U	U	U	O	O	O	U	U	U	O

HALF-CYCLE										
8	66	60	18	76	70	28	6	80	38	16
18	76	70	28	6	80	38	16	10	48	26
28	6	80	38	16	10	48	26	20	58	36
38	16	10	48	26	20	58	36	30	68	46
48	26	20	58	36	30	68	46	40	78	56
58	36	30	68	46	40	78	56	50	8	66
68	46	40	78	56	50	8	66	60	18	76
78	56	50	8	66	60	18	76	70	28	6
	U	U	O	O	O	U	U	U	O	O

HALF-CYCLE																															
10	26	20	58	36	30	68	46	40	78	56	50	8	66	76	6	16	26	36	42	4	46	52	14	56	62	24	66	72	34	76	2
20	36	30	68	46	40	78	56	50	8	66	60	18	76	6	16	26	36	46	52	14	56	62	24	66	72	34	76	2	44	6	12
30	46	40	78	56	50	8	66	60	18	76	70	28	6	16	26	36	46	56	62	24	66	72	34	76	2	44	6	12	54	16	22
40	56	50	8	66	60	18	76	70	28	6	80	38	16	26	36	46	56	66	72	34	76	2	44	6	12	54	16	22	64	26	32
50	66	60	18	76	70	28	6	80	38	16	10	48	26	36	46	56	66	76	2	44	6	12	54	16	22	64	26	32	74	36	42
60	76	70	28	6	80	38	16	10	48	26	20	58	36	46	56	66	76	6	12	54	16	22	64	26	32	74	36	42	4	46	52
70	6	80	38	16	10	48	26	20	58	36	30	68	46	56	66	76	6	16	22	64	26	32	74	36	42	4	46	52	14	56	62
80	16	10	48	26	20	58	36	30	68	46	40	78	56	66	76	6	16	26	32	74	36	42	4	46	52	14	56	62	24	66	72
	U	O	O	O	U	U	U	O	O	O	U	U	U	O	U	O	U	O	U	U	U	O	O	O	U	U	U	O	O	O	U

Fig. 1068 — Tables for the even-numbered half-cycles.

41. $L_1 \longrightarrow R_6$: $o - u - o - u - o$.
42. $R_6 \longrightarrow L_3$: $u - o - 2u$.
43. $L_3 \longrightarrow R_7$: $2u - 2o - 2u$.
44. $R_7 \longrightarrow L_2$: $2o - 2u - 2o - 2u$.
45. $L_2 \longrightarrow R_1$: $o - u - 2o - 3u - o - 2u - 2o - 2u - 2o - u$.
46. $R_1 \longrightarrow L_6$: $o - u - o - 2u - o$.
47. $L_6 \longrightarrow R_3$: $u - o - 2u$.
48. $R_3 \longrightarrow L_7$: $2u - 2o - 2u$.
49. $L_7 \longrightarrow R_2$: $2o - 2u - 2o - 2u$.
50. $R_2 \longrightarrow L_1$: $o - 2u - 2o - 3u - o - 4u - 2o - 2u - 2o - u$.

51. $L_1 \longrightarrow R_6$: $o-u-o-3u-o$.
52. $R_6 \longrightarrow L_3$: $u-2o-3u$.
53. $L_3 \longrightarrow R_7$: $2u-2o-2u-o$.
54. $R_7 \longrightarrow L_2$: $2o-2u-3o-2u$.
55. $L_2 \longrightarrow R_1$: $o-2u-3o-3u-o-4u-2o-2u-2o-u$.
56. $R_1 \longrightarrow L_6$: $o-u-2o-3u-o$.
57. $L_6 \longrightarrow R_3$: $u-2o-3u$.
58. $R_3 \longrightarrow L_7$: $2u-2o-2u-o$.
59. $L_7 \longrightarrow R_2$: $2o-2u-3o-2u$.
60. $R_2 \longrightarrow L_1$: $2o-2u-3o-3u-o-u-o-3u-2o-2u-3o-u$.
61. $L_1 \longrightarrow R_6$: $o-u-3o-3u-o$.
62. $R_6 \longrightarrow L_3$: $2u-3o-3u$.
63. $L_3 \longrightarrow R_7$: $2u-2o-3u-o$.
64. $R_7 \longrightarrow L_2$: $2o-3u-3o-2u$.
65. $L_2 \longrightarrow R_1$: $2o-3u-3o-3u-o-u-o-3u-2o-2u-3o-u$.
66. $R_1 \longrightarrow L_6$: $o-2u-3o-3u-o$.
67. $L_6 \longrightarrow R_3$: $2u-3o-3u$.
68. $R_3 \longrightarrow L_7$: $2u-2o-3u-o$.
69. $L_7 \longrightarrow R_2$: $2o-3u-3o-2u$.
70. $R_2 \longrightarrow L_1$: $u-2o-3u-3o-3u-o-2u-o-3u-2o-3u-3o-u$.
71. $L_1 \longrightarrow R_6$: $o-3u-3o-3u-o$.
72. $R_6 \longrightarrow L_3$: $o-3u-3o-3u$.
73. $L_3 \longrightarrow R_7$: $2u-3o-3u-o$.
74. $R_7 \longrightarrow L_2$: $3o-3u-3o-2u$.
75. $L_2 \longrightarrow R_1$: $u-3o-3u-3o-3u-o-2u-o-3u-2o-3u-3o-u$.
76. $R_1 \longrightarrow L_6$: $2o-3u-3o-3u-o$.
77. $L_6 \longrightarrow R_3$: $o-3u-3o-3u$.
78. $R_3 \longrightarrow L_7$: $2u-3o-3u-2o$.
79. $L_7 \longrightarrow R_2$: $3o-3u-3o-2u$.
80. $R_2 \longrightarrow L_1$: $u-3o-3u-3o-3u-o-u-o-u-o-3u-3o-3u-3o-u$.

Euclid's algorithm, the path formula, the path in the RKT and the algorithm diagram for the interbraided Regular Knot $p/b = 7/8$ between the bight-boundaries L_4 and R_5 and for the interbraided Regular Knot $p/b = 7/8$ between the bight-boundaries L_5 and R_4 are shown in Fig. 1069.

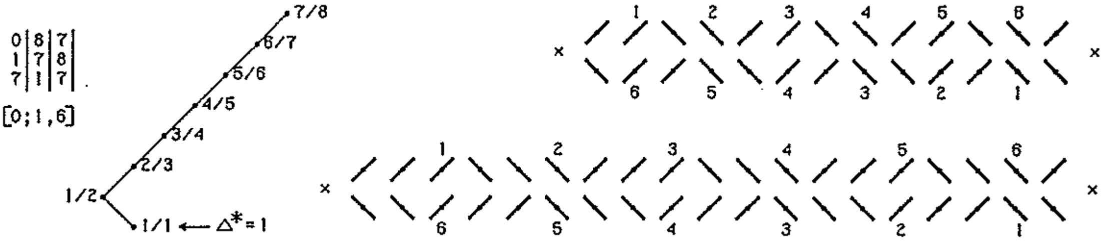

Fig. 1069 — Euclid's algorithm, path formula, path in RKT and algorithm diagrams for interbraided Regular Knots.

For the half-cycles 1′-16′ of the interbraided Regular Knot $p/b = 7/8$ between the bight-boundaries L_4 and R_5 we read the following half-cycle braiding algorithms from its algorithm diagram:

$1'$. : $o-u-o-u-o-u-o$.
$2'$. $(i=0)$: $o-u-o-u-o-u-o$.
$3'$. $(i=0)$: $o-u-o-u-o-u-o$.
$4'$. $(i\leq 1)$: $2o-u-o-u-o-u-o$.
$5'$. $(i\leq 1)$: $2o-u-o-u-o-u-o$.
$6'$. $(i\leq 2)$: $2o-2u-o-u-o-u-o$.
$7'$. $(i\leq 2)$: $2o-2u-o-u-o-u-o$.
$8'$. $(i\leq 3)$: $2o-2u-2o-u-o-u-o$.
$9'$. $(i\leq 3)$: $2o-2u-2o-u-o-u-o$.
$10'$. $(i\leq 4)$: $2o-2u-2o-2u-o-u-o$.
$11'$. $(i\leq 4)$: $2o-2u-2o-2u-o-u-o$.
$12'$. $(i\leq 5)$: $2o-2u-2o-2u-2o-u-o$.
$13'$. $(i\leq 5)$: $2o-2u-2o-2u-2o-u-o$.
$14'$. $(i\leq 6)$: $2o-2u-2o-2u-2o-2u-o$.
$15'$. $(i\leq 6)$: $2o-2u-2o-2u-2o-2u-o$.
$16'$. $(i\leq 7)$: $2o-2u-2o-2u-2o-2u-o$.

For the half-cycles $1''$-$16''$ of the interbraided Regular Knot $p/b=7/8$ between the bight-boundaries L_5 and R_4 we read the following half-cycle braiding algorithms from its algorithm diagram:

$1''$. : $2o-2u-2o-2u-2o-2u-o$.
$2''$. $(i=0)$: $o-2u-2o-2u-2o-2u-2o$.
$3''$. $(i=0)$: $2o-2u-2o-2u-2o-2u-o$.
$4''$. $(i\leq 1)$: $2o-2u-2o-2u-2o-2u-2o$.
$5''$. $(i\leq 1)$: $3o-2u-2o-2u-2o-2u-o$.
$6''$. $(i\leq 2)$: $2o-3u-2o-2u-2o-2u-2o$.
$7''$. $(i\leq 2)$: $3o-3u-2o-2u-2o-2u-o$.
$8''$. $(i\leq 3)$: $2o-3u-3o-2u-2o-2u-2o$.
$9''$. $(i\leq 3)$: $3o-3u-3o-2u-2o-2u-o$.
$10''$. $(i\leq 4)$: $2o-3u-3o-3u-2o-2u-2o$.
$11''$. $(i\leq 4)$: $3o-3u-3o-3u-2o-2u-o$.
$12''$. $(i\leq 5)$: $2o-3u-3o-3u-3o-2u-2o$.
$13''$. $(i\leq 5)$: $3o-3u-3o-3u-3o-2u-o$.
$14''$. $(i\leq 6)$: $2o-3u-3o-3u-3o-3u-2o$.
$15''$. $(i\leq 6)$: $3o-3u-3o-3u-3o-3u-o$.
$16''$. $(i\leq 7)$: $2o-3u-3o-3u-3o-3u-2o$.

As mentioned in Issue No. 55, pg. 1322, of *The Braider*, the foundation knots in these "new" type of Interbraided Cylindrical Braids contain in general a considerable length of string and hence we would normally braid them by starting at the centre of the required string-length. Thus in the above Example we would braid the first forty half-cycles in the upwards direction (odd numbered half-cycles from lower-left to upper-right; even numbered half-cycles from lower-right to upper-left), and the last forty half-cycles we would braid in the downwards direction (odd numbered half-cycles from upper-left to lower-right; even numbered half-cycles from upper-right to lower-left). The associated string-run diagram is then as shown in Fig. 1070 and the associated grid-diagram as shown in Fig. 1071. The first forty half-cycle braiding algorithms can be read from the tables in Figs. 1072 & 1073; they are identical to the half-cycle braiding algorithms 1-40 on pp. 1327-1329.

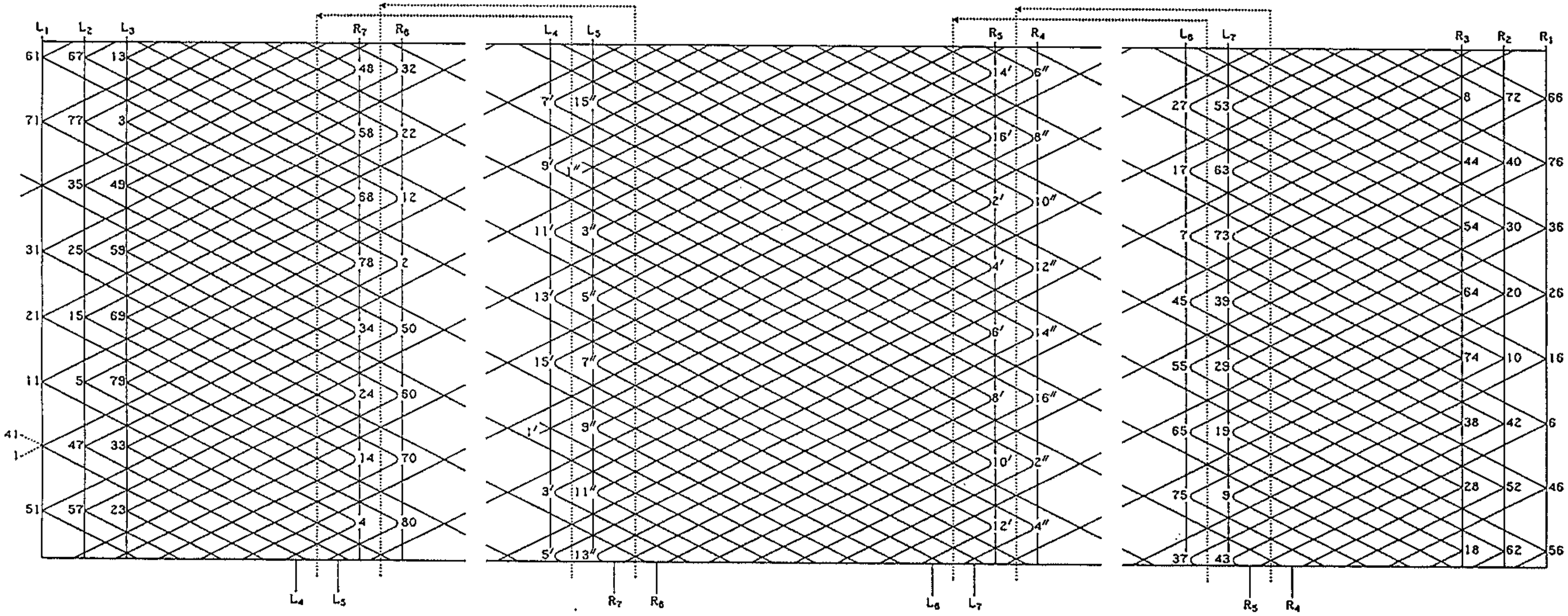

Fig. 1070 — The string-run of the Interbraided Cylindrical Braid.

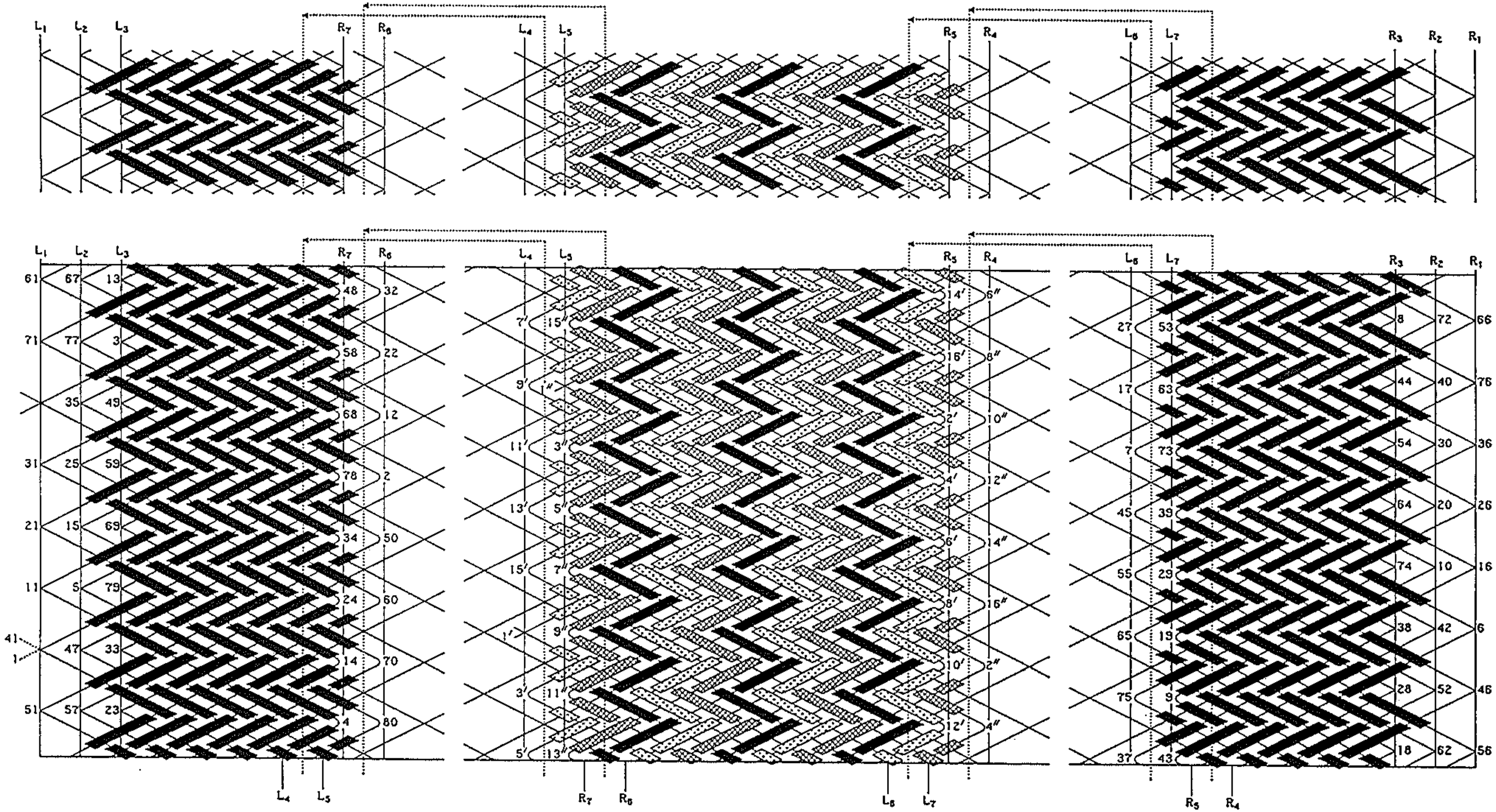

Fig. 1071 — The superimposed coding.

The first forty half-cycles are:

1. $L_1 \longrightarrow R_6$: Free run.
2. $R_6 \longrightarrow L_3$: Free run.
3. $L_3 \longrightarrow R_7$: Free run.
4. $R_7 \longrightarrow L_2$: u.
5. $L_2 \longrightarrow R_1$: u.
6. $R_1 \longrightarrow L_6$: Free run.
7. $L_6 \longrightarrow R_3$: Free run.
8. $R_3 \longrightarrow L_7$: u.
9. $L_7 \longrightarrow R_2$: u.
10. $R_2 \longrightarrow L_1$: $4u$.

HALF-CYCLE													
1	11	5	✕	21	15	✕	31	25	✕	✕	35	✕	✕
11	21	15	✕	31	25	✕	✕	35	✕	✕	✕	3	✕
21	31	25	✕	✕	35	✕	✕	✕	3	✕	✕	13	✕
31	✕	35	✕	✕	✕	3	✕	✕	13	✕	✕	23	✕
	O	O	O	U	U	U	O	O	O	U	U	U	O

HALF-CYCLE										
3	✕	✕	13	✕	✕	23	✕	✕	33	11
13	✕	✕	23	✕	✕	33	11	5	✕	21
23	✕	✕	33	11	5	✕	21	15	✕	31
33	11	5	✕	21	15	✕	31	25	✕	✕
	U	U	O	O	O	U	U	U	O	O

HALF-CYCLE											
7	11	17	✕	21	27	✕	31	37	✕	✕	✕
17	21	27	✕	31	37	✕	✕	✕	9	✕	✕
27	31	37	✕	✕	✕	9	✕	✕	19	✕	✕
37	✕	✕	9	✕	✕	19	✕	✕	29	✕	✕
	O	O	U	U	U	O	O	O	U	U	U

HALF-CYCLE											
9	✕	✕	19	✕	✕	29	✕	✕	39	✕	7
19	✕	✕	29	✕	✕	39	✕	7	✕	11	17
29	✕	✕	39	✕	7	✕	11	17	✕	21	27
39	✕	7	✕	11	17	✕	21	27	✕	31	37
	O	O	O	U	U	U	O	O	O	U	U

HALF-CYCLE																															
5	21	15	✕	31	25	✕	✕	35	✕	✕	✕	3	✕	✕	✕	11	21	31	37	✕	✕	✕	9	✕	✕	19	✕	✕	29	✕	✕
15	31	25	✕	✕	35	✕	✕	✕	3	✕	✕	13	✕	✕	11	21	31	✕	✕	9	✕	✕	19	✕	✕	29	✕	✕	39	✕	7
25	✕	35	✕	✕	✕	3	✕	✕	13	✕	✕	23	✕	11	21	31	✕	✕	✕	19	✕	✕	29	✕	✕	39	✕	7	✕	11	17
35	✕	✕	3	✕	✕	13	✕	✕	23	✕	✕	33	11	21	31	✕	✕	✕	✕	29	✕	✕	39	✕	7	49	11	17	✕	21	27
	U	O	O	O	U	U	U	O	O	O	U	U	U	O	U	O	U	O	U	U	U	O	O	O	U	U	U	O	O	O	U

Fig. 1072 — Tables for the first twenty odd-numbered half-cycles.

11. $L_1 \longrightarrow R_6$: u.
12. $R_6 \longrightarrow L_3$: u.
13. $L_3 \longrightarrow R_7$: $2u$.
14. $R_7 \longrightarrow L_2$: $o - 2u$.
15. $L_2 \longrightarrow R_1$: $o - 4u$.
16. $R_1 \longrightarrow L_6$: u.
17. $L_6 \longrightarrow R_3$: u.
18. $R_3 \longrightarrow L_7$: $o - 2u$.
19. $L_7 \longrightarrow R_2$: $o - 2u$.
20. $R_2 \longrightarrow L_1$: $o - u - o - 2u - 2o - u$.
21. $L_1 \longrightarrow R_6$: $o - u$.
22. $R_6 \longrightarrow L_3$: $o - u$.
23. $L_3 \longrightarrow R_7$: $2o - 2u$.
24. $R_7 \longrightarrow L_2$: $u - 2o - 2u$.
25. $L_2 \longrightarrow R_1$: $u - o - u - o - 2u - 2o - u$.
26. $R_1 \longrightarrow L_6$: $o - u$.
27. $L_6 \longrightarrow R_3$: $o - u$.

28. $R_3 \longrightarrow L_7$: $u - 2o - 2u$.
29. $L_7 \longrightarrow R_2$: $u - 2o - 2u$.
30. $R_2 \longrightarrow L_1$: $u - o - 2u - o - 4u - 2o - u$.

HALF-CYCLE											
2	6	12	☒	16	22	☒	26	32	☒	36	☒
12	16	22	☒	26	32	☒	36	☒	4	☒	☒
22	26	32	☒	36	☒	4	☒	☒	14	☒	☒
32	36	☒	4	☒	☒	14	☒	☒	24	☒	☒
	O	O	U	U	U	O	O	O	U	U	U

HALF-CYCLE											
4	☒	☒	14	☒	☒	24	☒	☒	34	☒	2
14	☒	☒	24	☒	☒	34	☒	2	☒	6	12
24	☒	☒	34	☒	2	☒	6	12	☒	16	22
34	☒	2	☒	6	12	☒	16	22	☒	26	32
	O	O	O	U	U	U	O	O	O	U	U

HALF-CYCLE													
6	16	10	☒	26	20	☒	36	30	☒	☒	40	☒	☒
16	26	20	☒	36	30	☒	☒	40	☒	☒	☒	8	☒
26	36	30	☒	☒	40	☒	☒	☒	8	☒	☒	18	☒
36	☒	40	☒	☒	☒	8	☒	☒	18	☒	☒	28	6
	O	O	O	U	U	U	O	O	O	U	U	U	O

HALF-CYCLE										
8	☒	☒	18	☒	☒	28	6	☒	38	16
18	☒	☒	28	6	☒	38	16	10	☒	26
28	6	☒	38	16	10	☒	26	20	☒	36
38	16	10	☒	26	20	☒	36	30	☒	☒
	U	U	O	O	O	U	U	U	O	O

HALF-CYCLE																															
10	26	20	☒	36	30	☒	☒	40	☒	☒	☒	8	☒	☒	6	16	26	36	☒	4	☒	☒	14	☒	☒	24	☒	☒	34	☒	2
20	36	30	☒	☒	40	☒	☒	☒	8	☒	☒	18	☒	6	16	26	36	☒	☒	14	☒	☒	24	☒	☒	34	☒	2	☒	6	12
30	☒	40	☒	☒	☒	8	☒	☒	18	☒	☒	28	6	16	26	36	☒	☒	☒	24	☒	☒	34	☒	2	☒	6	12	☒	16	22
40	☒	☒	8	☒	☒	18	☒	☒	28	6	☒	38	16	26	36	☒	☒	☒	☒	34	☒	2	☒	6	12	☒	16	22	☒	26	32
	U	O	O	O	U	U	U	O	O	O	U	U	U	O	U	O	U	O	U	U	U	O	O	O	U	U	U	O	O	O	U

Fig. 1073 — Tables for the first twenty even-numbered half-cycles.

31. $L_1 \longrightarrow R_6$: $u - o - u$.
32. $R_6 \longrightarrow L_3$: $u - o - u$.
33. $L_3 \longrightarrow R_7$: $2u - 2o - 2u$.
34. $R_7 \longrightarrow L_2$: $o - 2u - 2o - 2u$.
35. $L_2 \longrightarrow R_1$: $o - u - o - 2u - o - 4u - 2o - u$.
36. $R_1 \longrightarrow L_6$: $u - o - u - o$.
37. $L_6 \longrightarrow R_3$: $u - o - u$.
38. $R_3 \longrightarrow L_7$: $2u - 2o - 2u$.
39. $L_7 \longrightarrow R_2$: $o - 2u - 2o - 2u$.
40. $R_2 \longrightarrow L_1$: $o - u - 2o - 2u - o - 2u - 2o - 2u - 2o - u$.

Since the braiding directions for the odd-numbered and even-numbered half-cycles of the last forty half-cycles are opposite to the braiding directions for the odd-numbered and even-numbered half-cycle of the first forty half-cycles, we require for the first forty half-cycles and for the last forty half-cycles a separate set of tables. In the tables for the first forty half-cycles (Figs. 1072 and 1073) we have for convenience restricted the intersection cell entries to the first forty half-cycles.

It will have been noted that in tables associated with braiding all odd-numbered half-cycles and all even-numbered half-cycles in their same respective direction, the consecutive vertically aligned lower entry is $|a + f|_b$, where a equals the vertically aligned upper entry, f equals the number of half-cycles in the first-return string-run, b equals the number of bights of the (sub)component associated with the first-return string-run. Hence the simplest way to set up the odd-numbered and even-numbered half-cycle tables for the last forty half-cycles is to take for the Standing End of the total string-run (the eighty half-cycles) the end-point of half-cycle forty. From these tables read only for the half-cycles 41-80 the half-cycle braiding algorithms.†

41. $L_1 \longrightarrow R_2$: $o - u - o - 2u - o - u - o - u - o - 2u - 2o - u$.
42. $R_2 \longrightarrow L_7$: $o - u - 2o$.
43. $L_7 \longrightarrow R_3$: $2o - u - o$.
44. $R_3 \longrightarrow L_6$: $2u - 2o - 2u - 2o$.
45. $L_6 \longrightarrow R_1$: $2u - 2o - 2u - 3o$.

HALF-CYCLE																															
1	11	17	59	21	27	69	31	37	79	41	47	9	51	57	67	77	7	17	27	5	43	37	15	53	47	25	63	57	35	73	67
11	21	27	69	31	37	79	41	47	9	51	57	19	61	67	77	7	17	27	37	15	53	47	25	63	57	35	73	67	45	3	77
21	31	37	79	41	47	9	51	57	19	61	67	29	71	77	7	17	27	37	47	25	63	57	35	73	67	45	3	77	55	13	7
31	41	47	9	51	57	19	61	67	29	71	77	39	☒	7	17	27	37	47	57	35	73	67	45	3	77	55	13	7	65	23	17
41	51	57	19	61	67	29	71	77	39	☒	7	49	11	17	27	37	47	57	67	45	3	77	55	13	7	65	23	17	75	33	27
51	61	67	29	71	77	39	☒	7	49	11	17	59	21	27	37	47	57	67	77	55	13	7	65	23	17	75	33	27	5	43	37
61	71	77	39	☒	7	49	11	17	59	21	27	69	31	37	47	57	67	77	7	65	23	17	75	33	27	5	43	37	15	53	47
71	☒	7	49	11	17	59	21	27	69	31	37	79	41	47	57	67	77	7	17	75	33	27	5	43	37	15	53	47	25	63	57
	U	O	O	O	U	U	U	O	O	O	U	U	U	O	U	O	U	O	U	U	U	O	O	O	U	U	U	O	O	O	U

HALF-CYCLE										
3	77	55	13	7	65	23	17	75	33	27
13	7	65	23	17	75	33	27	5	43	37
23	17	75	33	27	5	43	37	15	53	47
33	27	5	43	37	15	53	47	25	63	57
43	37	15	53	47	25	63	57	35	73	67
53	47	25	63	57	35	73	67	45	3	77
63	57	35	73	67	45	3	77	55	13	7
73	67	45	3	77	55	13	7	65	23	17
	O	O	U	U	U	O	O	O	U	U

HALF-CYCLE													
5	37	15	53	47	25	63	57	35	73	67	45	3	77
15	47	25	63	57	35	73	67	45	3	77	55	13	7
25	57	35	73	67	45	3	77	55	13	7	65	23	17
35	67	45	3	77	55	13	7	65	23	17	75	33	27
45	77	55	13	7	65	23	17	75	33	27	5	43	37
55	7	65	23	17	75	33	27	5	43	37	15	53	47
65	17	75	33	27	5	43	37	15	53	47	25	63	57
75	27	5	43	37	15	53	47	25	63	57	35	73	67
	O	U	U	U	O	O	O	U	U	U	O	O	O

HALF-CYCLE											
7	11	17	59	21	27	69	31	37	79	41	47
17	21	27	69	31	37	79	41	47	9	51	57
27	31	37	79	41	47	9	51	57	19	61	67
37	41	47	9	51	57	19	61	67	29	71	77
47	51	57	19	61	67	29	71	77	39	☒	7
57	61	67	29	71	77	39	☒	7	49	11	17
67	71	77	39	☒	7	49	11	17	59	21	27
77	☒	7	49	11	17	59	21	27	69	31	37
	U	U	O	O	O	U	U	U	O	O	O

HALF-CYCLE											
9	51	57	19	61	67	29	71	77	39	☒	7
19	61	67	29	71	77	39	☒	7	49	11	17
29	71	77	39	☒	7	49	11	17	59	21	27
39	☒	7	49	11	17	59	21	27	69	31	37
49	11	17	59	21	27	69	31	37	79	41	47
59	21	27	69	31	37	79	41	47	9	51	57
69	31	37	79	41	47	9	51	57	19	61	67
79	41	47	9	51	57	19	61	67	29	71	77
	U	U	U	O	O	O	U	U	U	O	O

Fig. 1074 — Tables for the odd-numbered half-cycles > 40.

46. $R_1 \longrightarrow L_2$: $o - u - 3o - 2u - o - u - o - u - 2o - 2u - 2o - u$.
47. $L_2 \longrightarrow R_7$: $o - u - 2o$.
48. $R_7 \longrightarrow L_3$: $2o - u - o$.
49. $L_3 \longrightarrow R_6$: $2u - 2o - 2u - 2o$.
50. $R_6 \longrightarrow L_1$: $o - 2u - 2o - 2u - 3o$.
51. $L_1 \longrightarrow R_2$: $o - u - 3o - 2u - o - u - o - u - 2o - 2u - 3o - u$.
52. $R_2 \longrightarrow L_7$: $o - 2u - 3o$.

---

† Note that for half-cycle n, where $n > 40$ the intersection cells with numbers $\leq n$ are the correct intersection cells although those with numbers ≤ 40 do not carry their actual number. These tables can therefore only be used for the half-cycles 41-80.

53. $L_7 \longrightarrow R_3$: $2o - u - o - u$.
54. $R_3 \longrightarrow L_6$: $2u - 2o - 3u - 2o$.
55. $L_6 \longrightarrow R_1$: $o - 2u - 2o - 3u - 3o$.
56. $R_1 \longrightarrow R_2$: $o - 3u - 3o - 2u - o - u - o - 2u - 2o - 2u - 3o - u$.
57. $R_2 \longrightarrow R_7$: $o - 2u - 3o$.
58. $R_7 \longrightarrow L_3$: $2o - u - o - 2u$.
59. $L_3 \longrightarrow R_6$: $2u - 2o - 3u - 2o$.

HALF-CYCLE											
2	6	12	54	16	22	64	26	32	74	36	42
12	16	22	64	26	32	74	36	42	4	46	52
22	26	32	74	36	42	4	46	52	14	56	62
32	36	42	4	46	52	14	56	62	24	66	72
42	46	52	14	56	62	24	66	72	34	76	2
52	56	62	24	66	72	34	76	2	44	6	12
62	66	72	34	76	2	44	6	12	54	16	22
72	76	2	44	6	12	54	16	22	64	26	32
	U	U	O	O	O	U	U	U	O	O	O

HALF-CYCLE											
4	46	52	14	56	62	24	66	72	34	76	2
14	56	62	24	66	72	34	76	2	44	6	12
24	66	72	34	76	2	44	6	12	54	16	22
34	76	2	44	6	12	54	16	22	64	26	32
44	6	12	54	16	22	64	26	32	74	36	42
54	16	22	64	26	32	74	36	42	4	46	52
64	26	32	74	36	42	4	46	52	14	56	62
74	36	42	4	46	52	14	56	62	24	66	72
	U	U	U	O	O	O	U	U	U	O	O

HALF-CYCLE																															
6	16	22	64	26	32	74	36	42	4	46	52	14	56	62	72	2	12	22	32	10	48	42	20	58	52	30	68	62	40	78	72
16	26	32	74	36	42	4	46	52	14	56	62	24	66	72	2	12	22	32	42	20	58	52	30	68	62	40	78	72	50	8	2
26	36	42	4	46	52	14	56	62	24	66	72	34	76	2	12	22	32	42	52	30	68	62	40	78	72	50	8	2	60	18	12
36	46	52	14	56	62	24	66	72	34	76	2	44	6	12	22	32	42	52	62	40	78	72	50	8	2	60	18	12	70	28	22
46	56	62	24	66	72	34	76	2	44	6	12	54	16	22	32	42	52	62	72	50	8	2	60	18	12	70	28	22	80	38	32
56	66	72	34	76	2	44	6	12	54	16	22	64	26	32	42	52	62	72	2	60	18	12	70	28	22	80	38	32	10	48	42
66	76	2	44	6	12	54	16	22	64	26	32	74	36	42	52	62	72	2	12	70	28	22	80	38	32	10	48	42	20	58	52
76	6	12	54	16	22	64	26	32	74	36	42	4	46	62	62	72	2	12	22	80	38	32	10	48	42	20	58	52	30	68	62
	U	O	O	O	U	U	U	O	O	O	U	U	U	O	U	O	U	O	U	U	U	O	O	O	U	U	U	O	O	O	U

HALF-CYCLE										
8	2	60	18	12	70	28	22	80	38	32
18	12	70	28	22	80	38	32	10	48	42
28	22	80	38	32	10	48	42	20	58	52
38	32	10	48	42	20	58	52	30	68	62
48	42	20	58	52	30	68	62	40	78	72
58	52	30	68	62	40	78	72	50	8	2
68	62	40	78	72	50	8	2	60	18	12
78	72	50	8	2	60	18	12	70	28	22
	O	O	U	U	U	O	O	O	U	U

HALF-CYCLE													
10	42	20	58	52	30	68	62	40	78	72	50	8	2
20	52	30	68	62	40	78	72	50	8	2	60	18	12
30	62	40	78	72	50	8	2	60	18	12	70	28	22
40	72	60	8	2	60	18	12	70	28	22	80	38	32
50	2	60	18	12	70	28	22	80	38	32	10	48	42
60	12	70	28	22	80	38	32	10	48	42	20	58	52
70	22	80	38	32	10	48	42	20	58	52	30	68	62
80	32	10	48	42	20	58	52	30	68	62	40	78	72
	O	U	U	U	O	O	O	U	U	U	O	O	O

Fig. 1075 — Tables for the even-numbered half-cycles > 40.

60. $R_6 \longrightarrow L_1$: $o - 2u - 2o - 3u - 3o$.
61. $L_1 \longrightarrow R_2$: $o - 3u - 3o - 2u - o - u - o - 2u - 2o - 3u - 3o - u$.
62. $R_2 \longrightarrow L_7$: $2o - 3u - 3o$.
63. $L_7 \longrightarrow R_3$: $2o - u - 2o - 2u$.
64. $R_3 \longrightarrow L_6 6$: $2u - 3o - 3u - 2o$.
65. $L_6 \longrightarrow R_1$: $o - 2u - 3o - 3u - 3o$.
66. $R_1 \longrightarrow L_2$: $3o - 3u - 3o - 2u - o - u - 2o - 2u - 2o - 3u - 3o - u$.
67. $L_2 \longrightarrow R_7$: $2o - 3u - 3o$.
68. $R_7 \longrightarrow L_3$: $2o - u - 3o - 2u$.
69. $L_3 \longrightarrow R_6$: $2u - 3o - 3u - 2o$.

70. $R_6 \longrightarrow L_1$: $o - 2u - 3o - 3u - 3o$.
71. $L_1 \longrightarrow R_2$: $3o - 3u - 3o - 2u - o - u - 2o - 2u - 3o - 3u - 3o - u$.
72. $R_2 \longrightarrow L_7$: $u - 3o - 3u - 3o$.
73. $L_7 \longrightarrow R_3$: $2o - 2u - 3o - 2u$.
74. $R_3 \longrightarrow L_6$: $3u - 3o - 3u - 2o$.
75. $L_6 \longrightarrow R_1$: $o - 3u - 3o - 3u - 3o$.
76. $R_1 \longrightarrow L_2$: $u - 3o - 3u - 3o - 3u - o - u - o - u - o - 2u - 3o - 3u - 3o - u$.
77. $L_2 \longrightarrow R_7$: $u - 3o - 3u - 3o$.
78. $R_7 \longrightarrow L_3$: $2o - 3u - 3o - 2u$.
79. $L_3 \longrightarrow R_6$: $3u - 3o - 3u - 2o$.
80. $R_6 \longrightarrow L_1$: $o - 3u - 3o - 3u - 3o$.

In our grid-diagram on pg. 1326, Fig. 1066, the values of C_1 and C_3 are both 11 and the associated first-return string-run of the foundation knot was depicted in Fig. 1063, pg. 1323. The same first-return string-run form will be obtained when $C_1 = 5 + 6n$ and $C_3 = 5 + 6m$, where n and m are whole numbers.

In the upper grid-diagram of Fig. 1076 the C_1 and C_3 values are both increased by 2 and the associated first-return string-run of the foundation knot is depicted in Fig. 1077. This first-return string-run form will be associated with foundation knots wherein $C_1 = 7 + 6n$ and $C_3 = 7 + 6m$, where n and m are whole numbers.

In the lower grid-diagram of Fig. 1076 the C_1 and C_3 values are both increased by 4 and the associated first-return string-run of the foundation knot is depicted in Fig. 1078. This first-return string-run form will be associated with foundation knots wherein $C_1 = 3 + 6n$ and $C_3 = 3 + 6m$, where n and m are whole numbers.

In the upper grid-diagram of Fig. 1079 the C_3 value is increased by 2 and the associated first-return string-run of the foundation knot is depicted in Fig. 1080. This first-return string-run form will be associated with foundation knots wherein $C_1 = 5 + 6n$ and $C_3 = 7 + 6m$, where n and m are whole numbers.

In the lower grid-diagram of Fig. 1079 the C_3 value is increased by 4 and the associated first-return string-run of the foundation knot is depicted in Fig. 1081. This first-return string-run form will be associated with foundation knots wherein $C_1 = 5 + 6n$ and $C_3 = 3 + 6m$, where n and m are whole numbers.

In the upper grid-diagram of Fig. 1082 the C_1 value is increased by 2 and the associated first-return string-run of the foundation knot is depicted in Fig. 1083. This first-return string-run form will be associated with foundation knots wherein $C_1 = 7 + 6n$ and $C_3 = 5 + 6m$, where n and m are whole numbers.

In the lower grid-diagram of Fig. 1082 the C_1 value is increased by 4 and the associated first-return string-run of the foundation knot is depicted in Fig. 1084. This first-return string-run form will be associated with foundation knots wherein $C_1 = 3 + 6n$ and $C_3 = 5 + 6m$, where n and m are whole numbers.

In the upper grid-diagram of Fig. 1085 the C_1 value is increased by 2 and the C_3 value by 4. The associated first-return string-run of the foundation knot is depicted in Fig. 1086. This first-return string-run form will be associated with foundation knots wherein $C_1 = 7 + 6n$ and $C_3 = 3 + 6m$, where n and m are whole numbers.

In the lower grid-diagram of Fig. 1085 the C_1 value is increased by 4 and the C_3 value by 2. The associated first-return string-run of the foundation knot is depicted in Fig. 1087. This first-return string-run form will be associated with foundation knots wherein $C_1 = 3 + 6n$ and $C_3 = 7 + 6m$, where n and m are whole numbers.

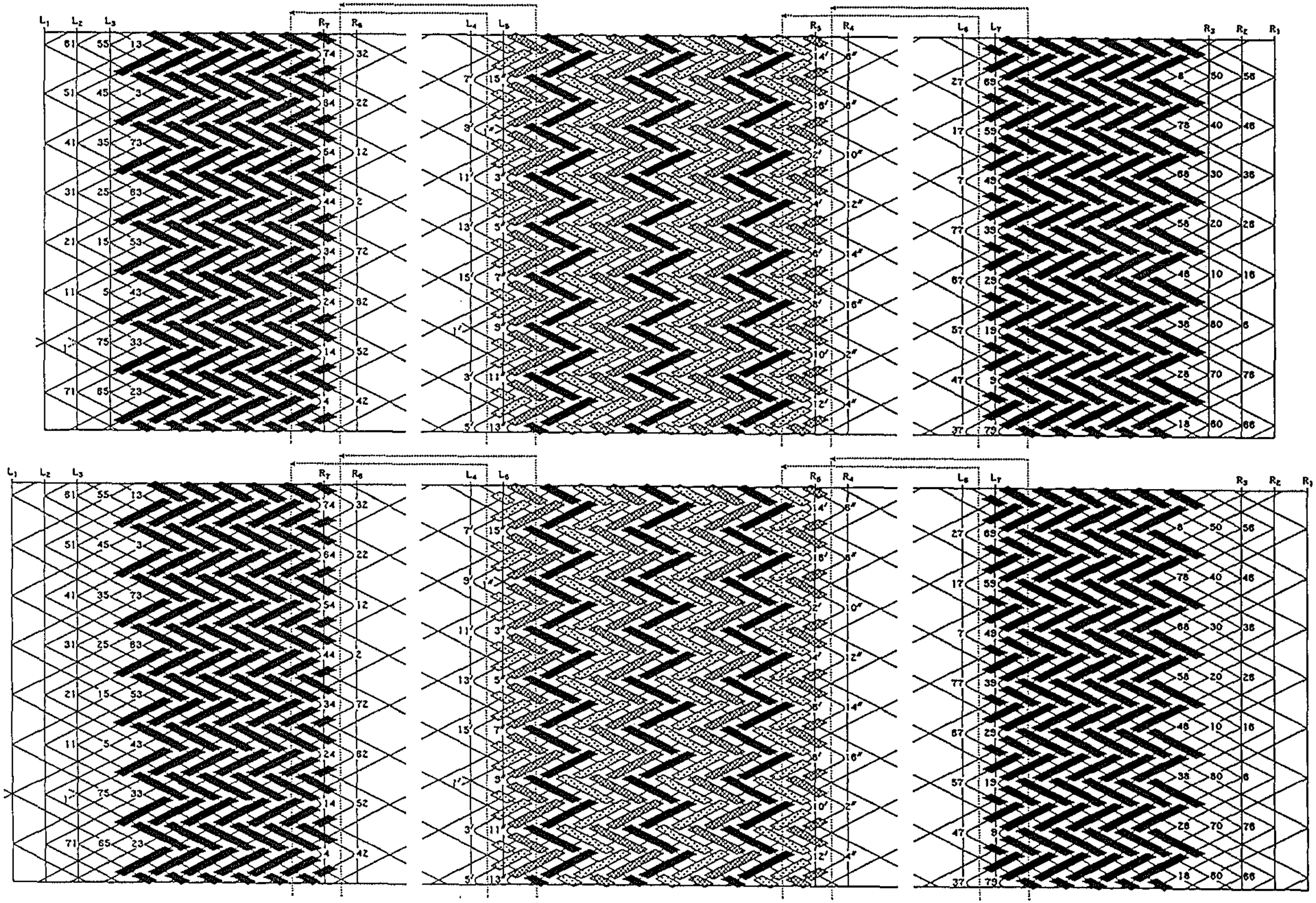

Fig. 1076 — See text pg. 1338.

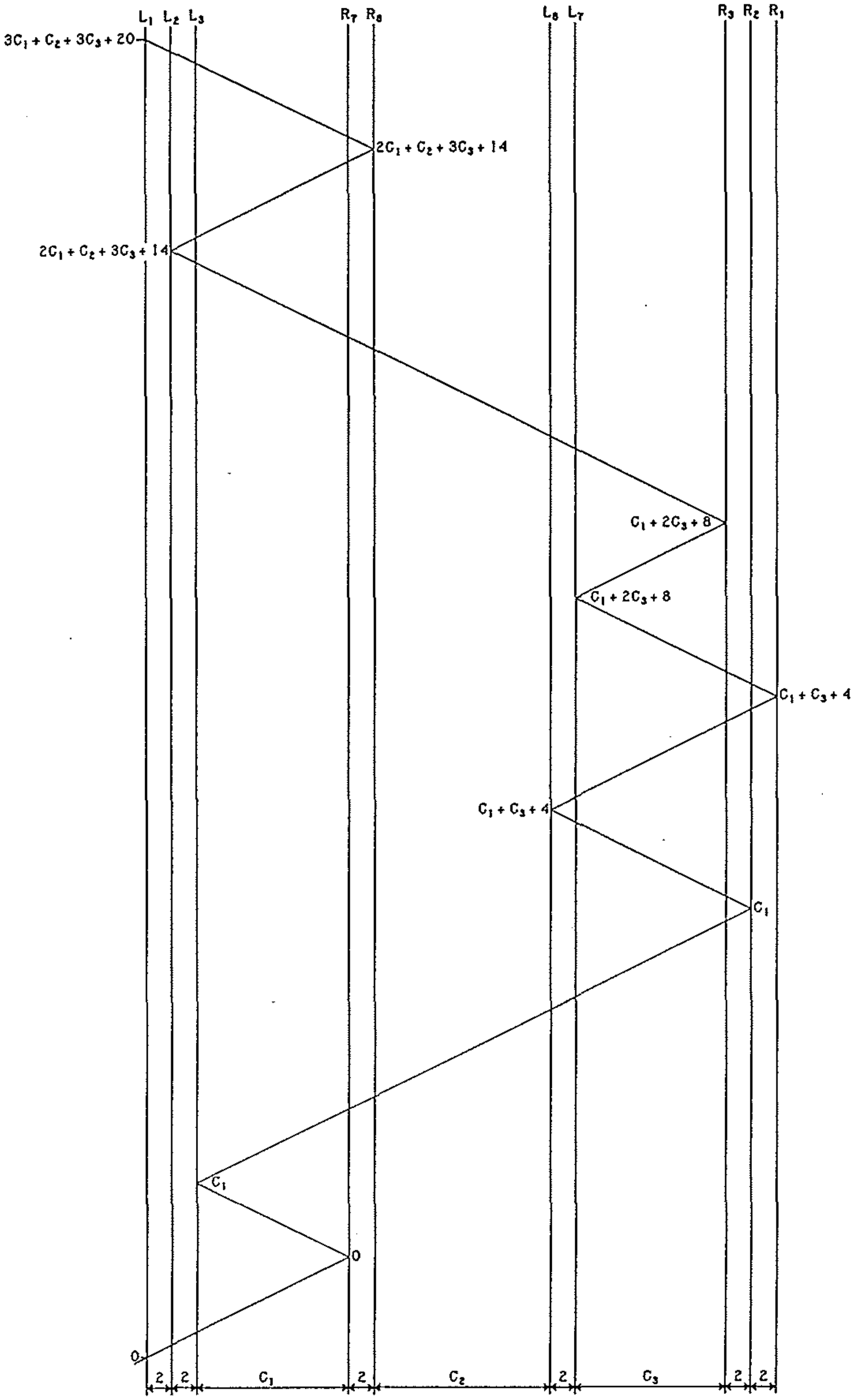

Fig. 1077 — The first-return string-run of the foundation knot.

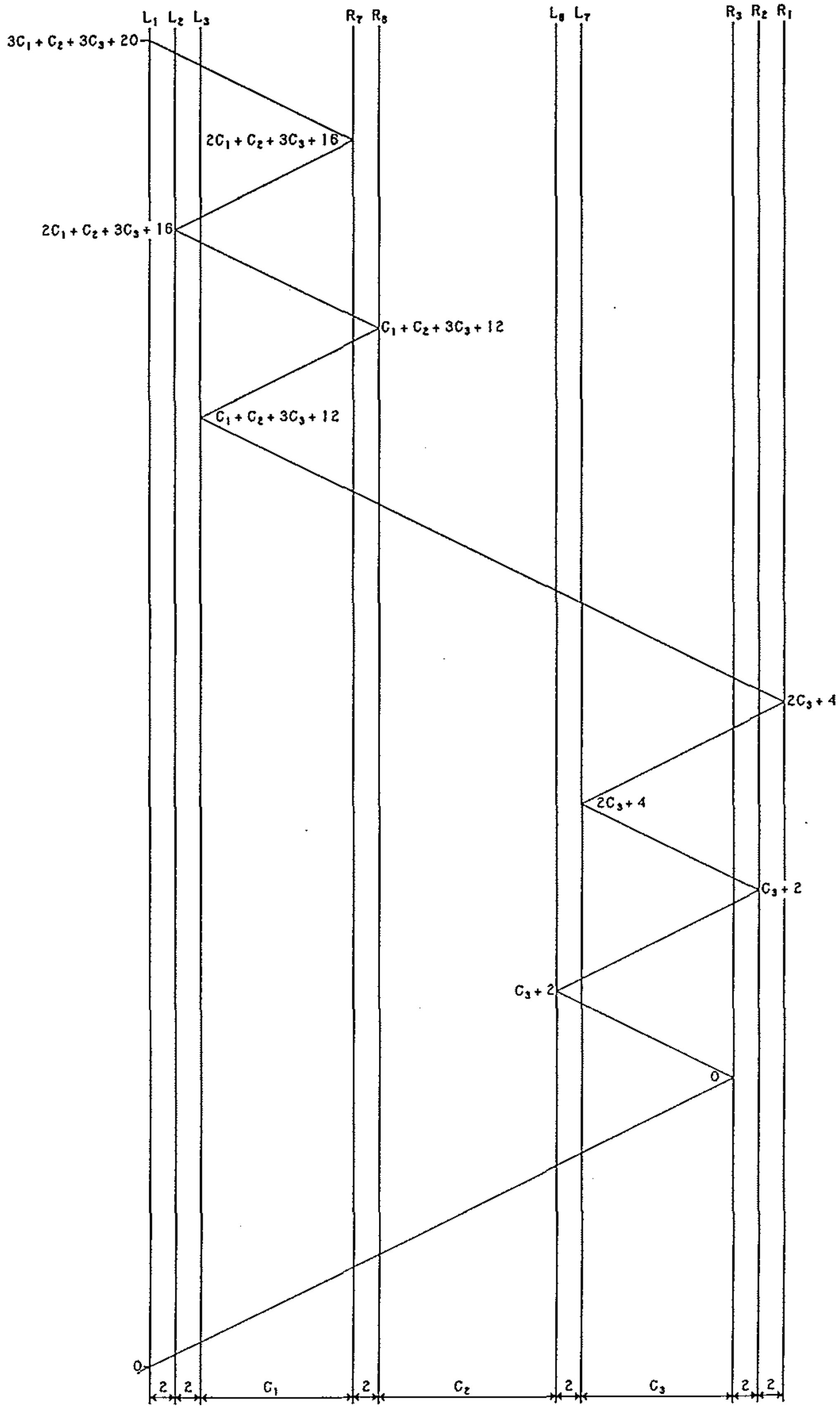

Fig. 1078 — The first-return string-run of the foundation knot.

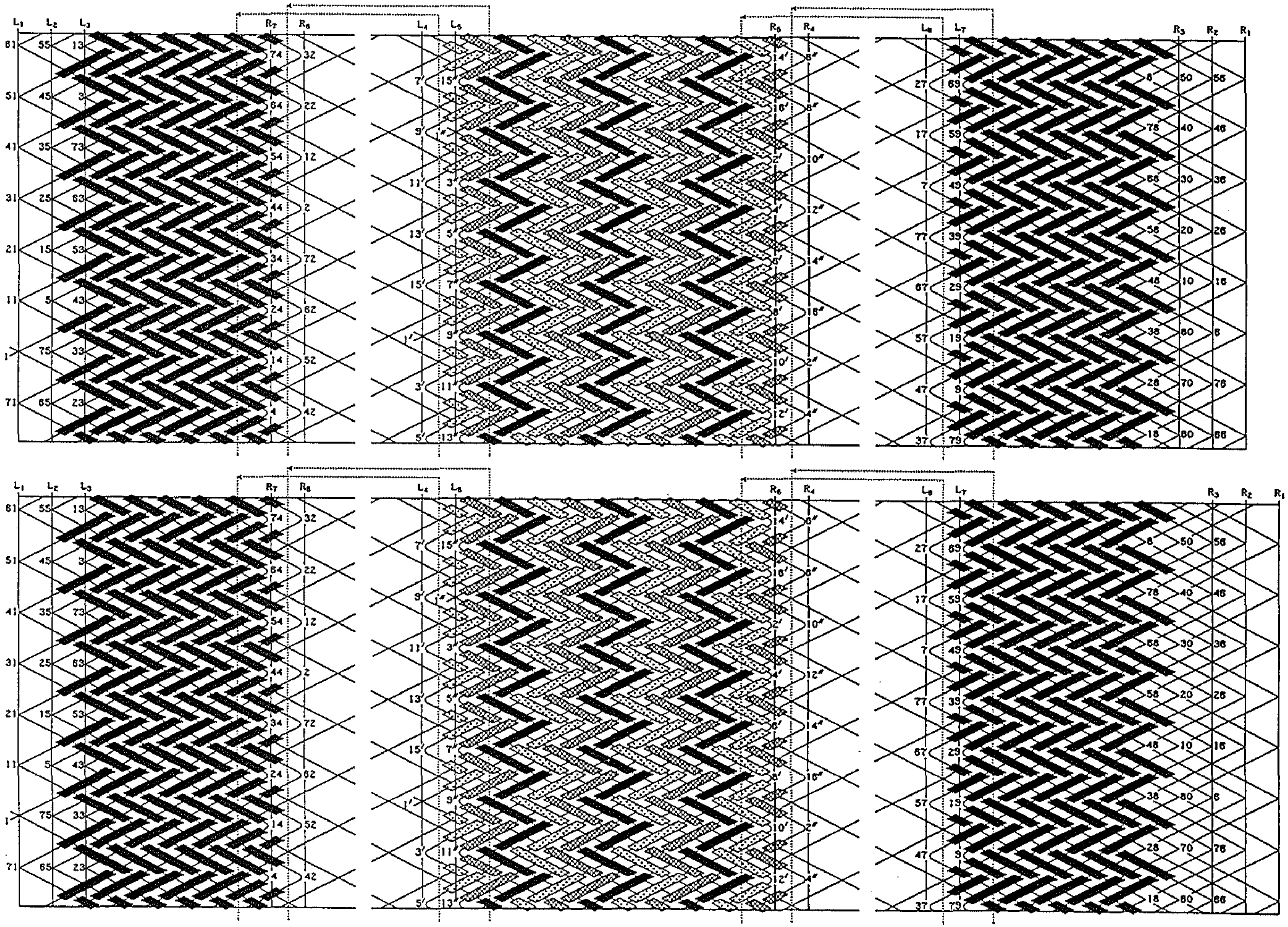

Fig. 1079 — See text pg. 1338.

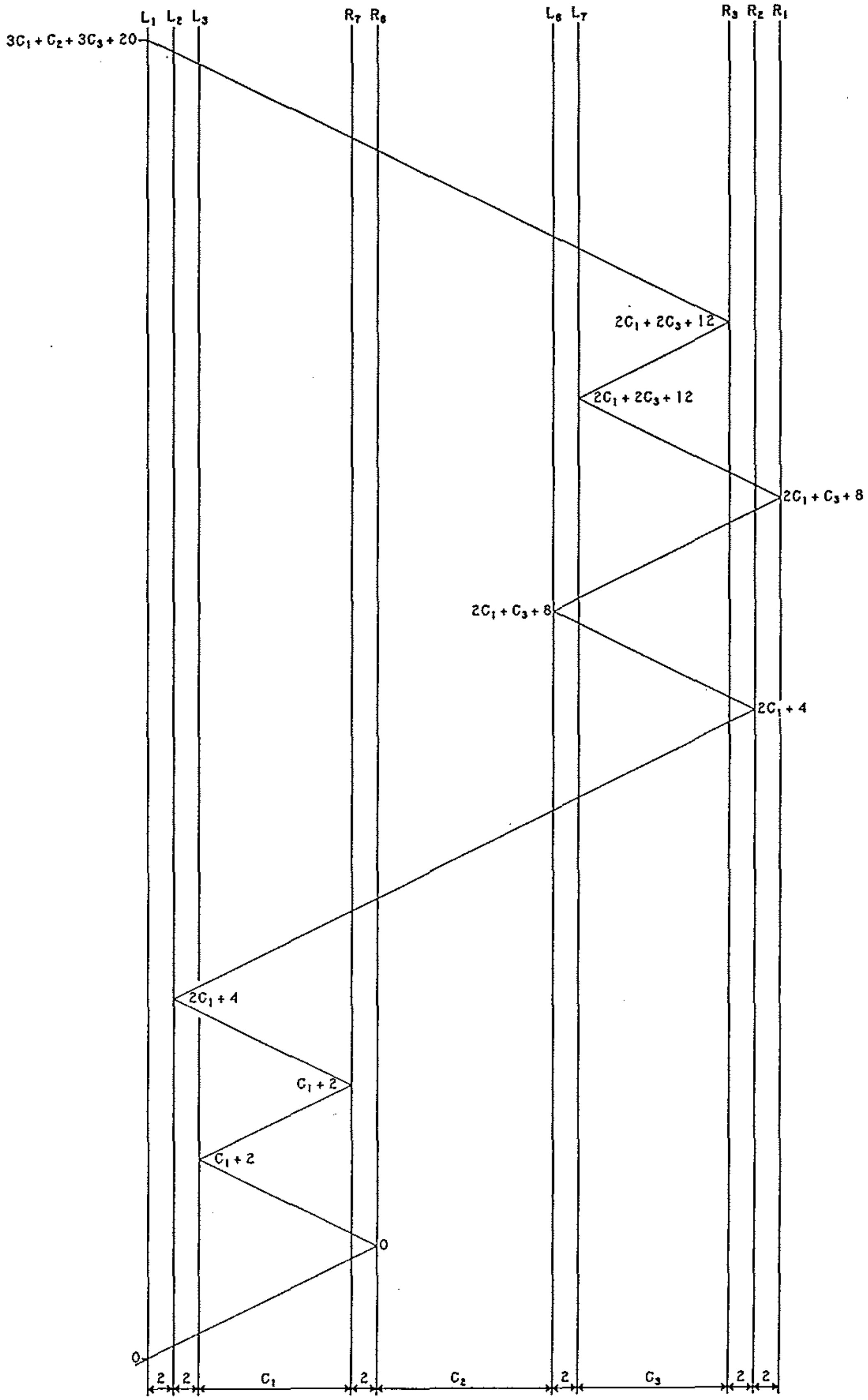

Fig. 1080 — The first-return string-run of the foundation knot.

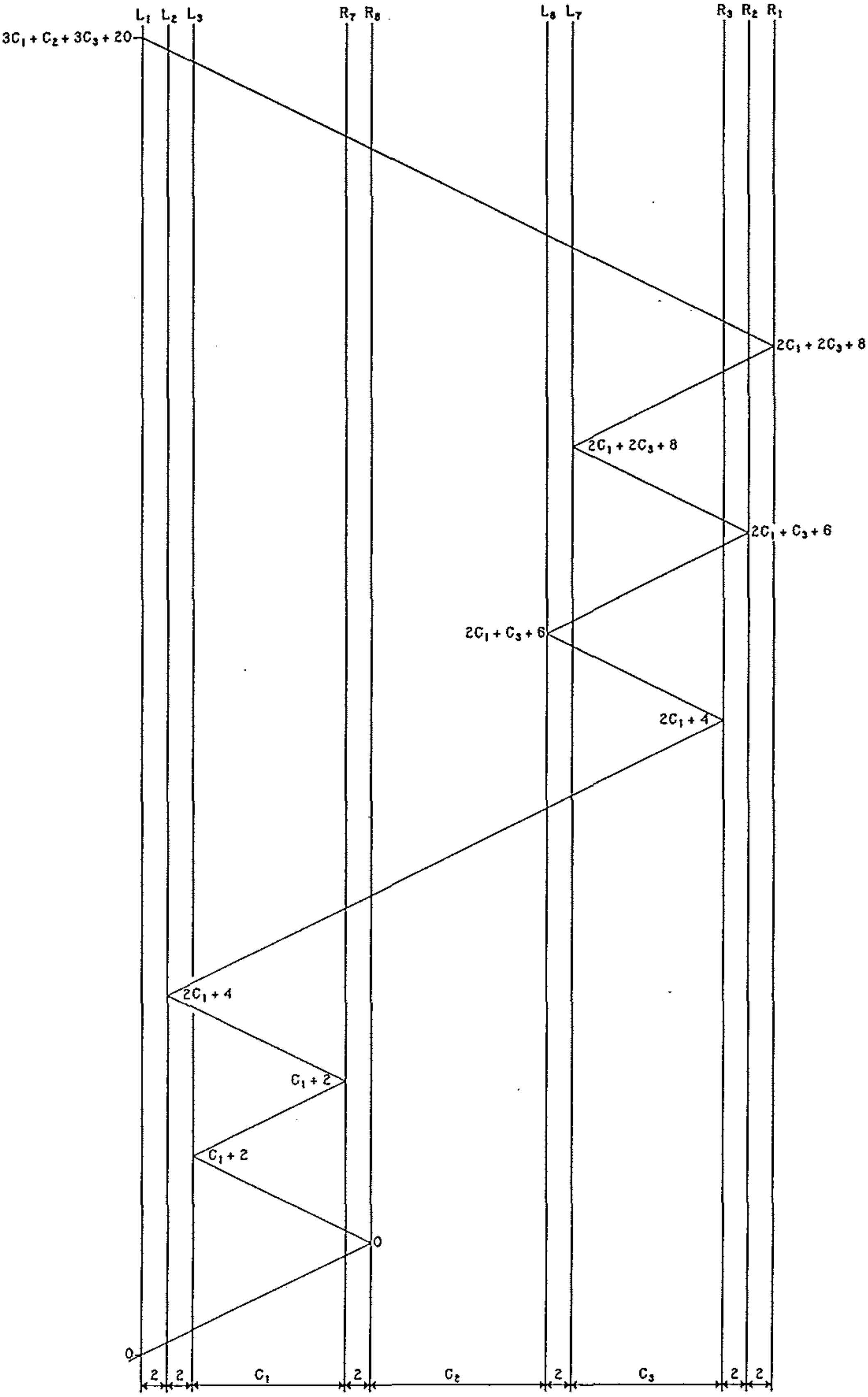

Fig. 1081 — The first-return string-run of the foundation knot.

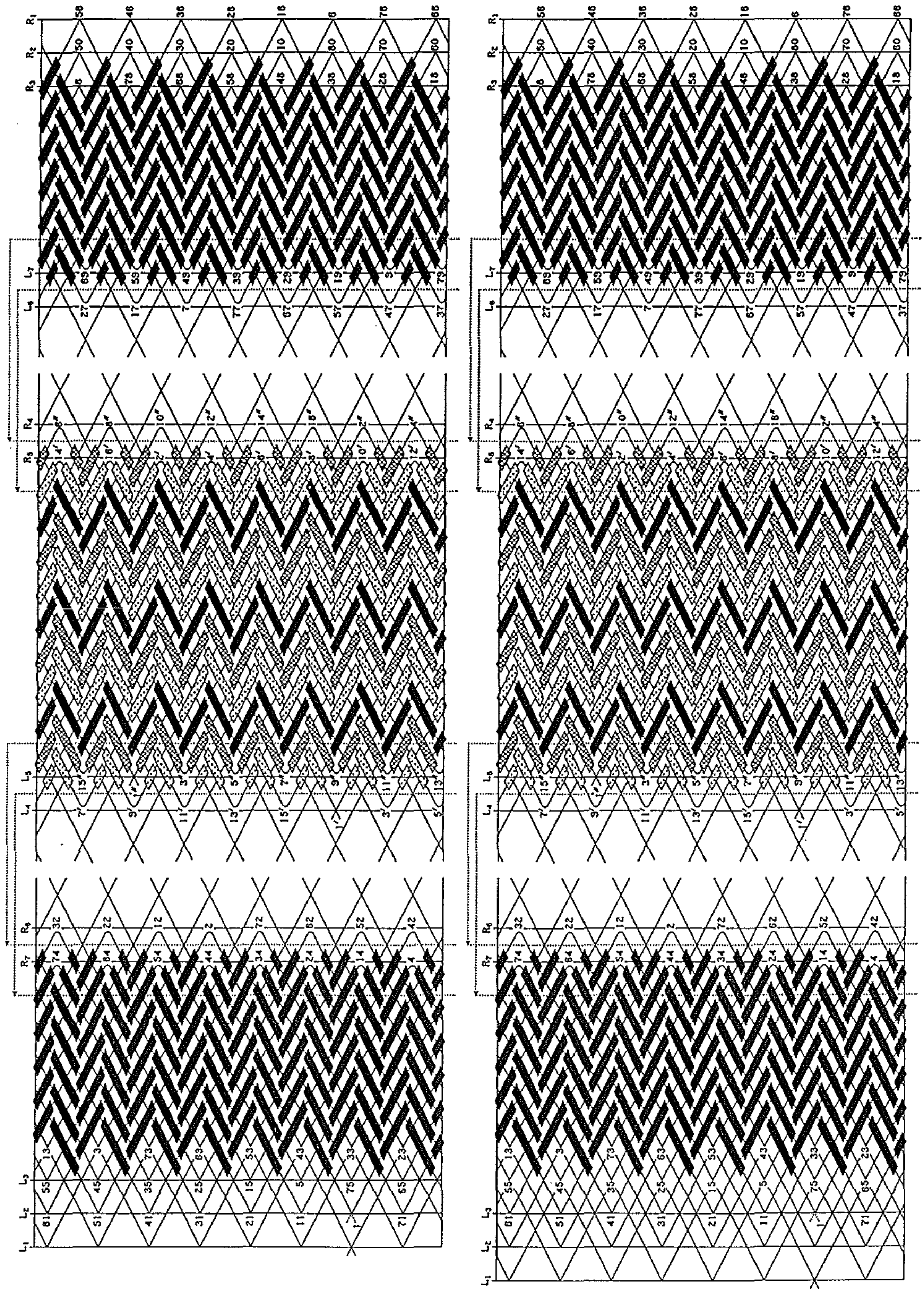
R1 56 46 36 26 16 6 76 66
R2 50 40 30 20 10 80 70 60
R3 8 78 68 58 48 38 28 18
L7 69 59 49 39 29 19 9 79
L6 27 17 7 77 67 57 47 37
R4 6" 8" 10" 12" 14" 16" 2" 4"
R5
L5 15' 1" 3" 5" 7" 9" 11" 13"
L4 7' 9' 11' 13' 15' 17' 3' 5'
R6 32 22 12 2 72 62 52 42
R7 74 64 54 44 34 24 14 4
13 3 73 63 53 43 33 23
L3 55 45 35 25 15 5 75 65
L2 61 51 41 31 21 11 1 71
L1

Fig. 1082 — See text pg. 1338.

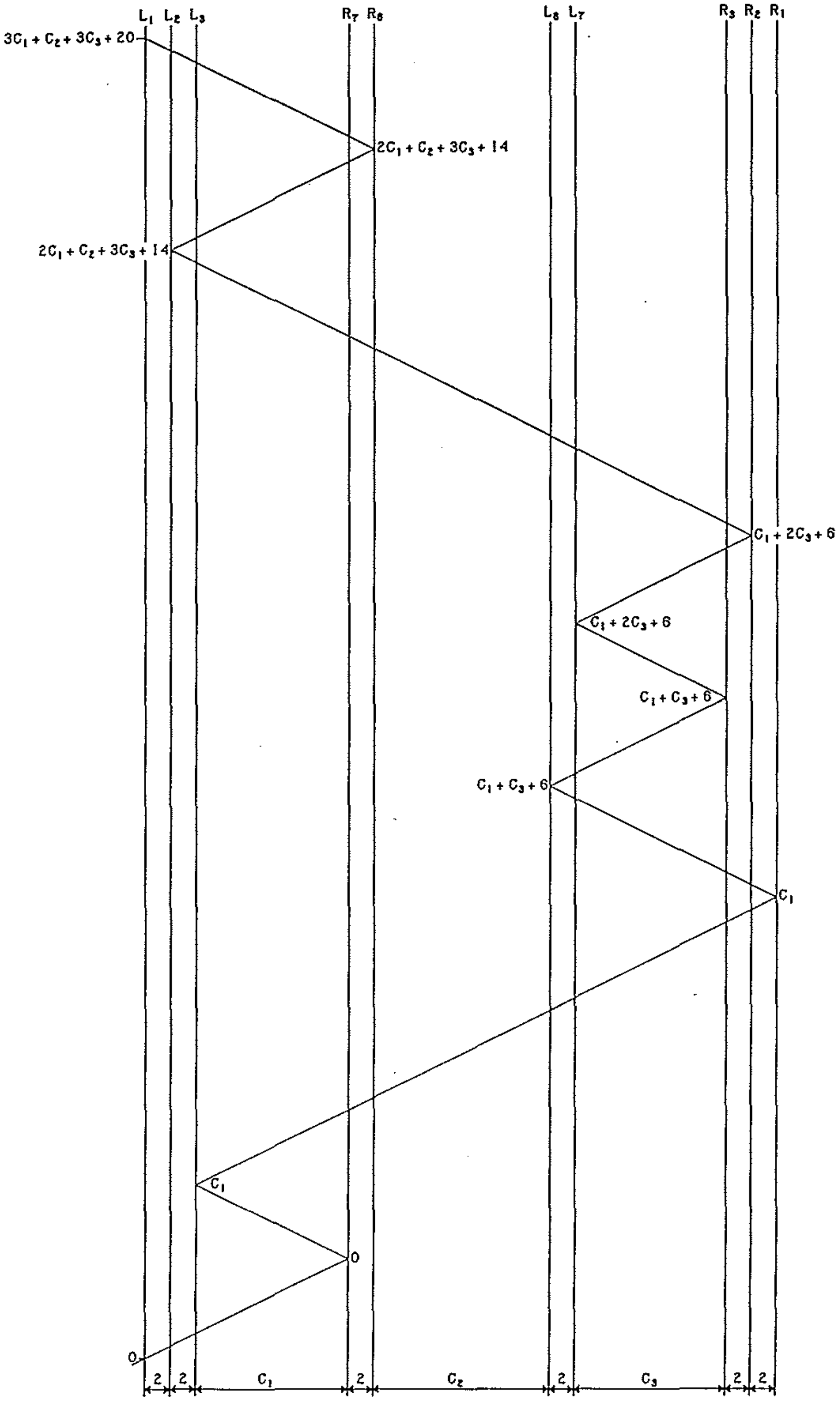

Fig. 1083 — The first-return string-run of the foundation knot.

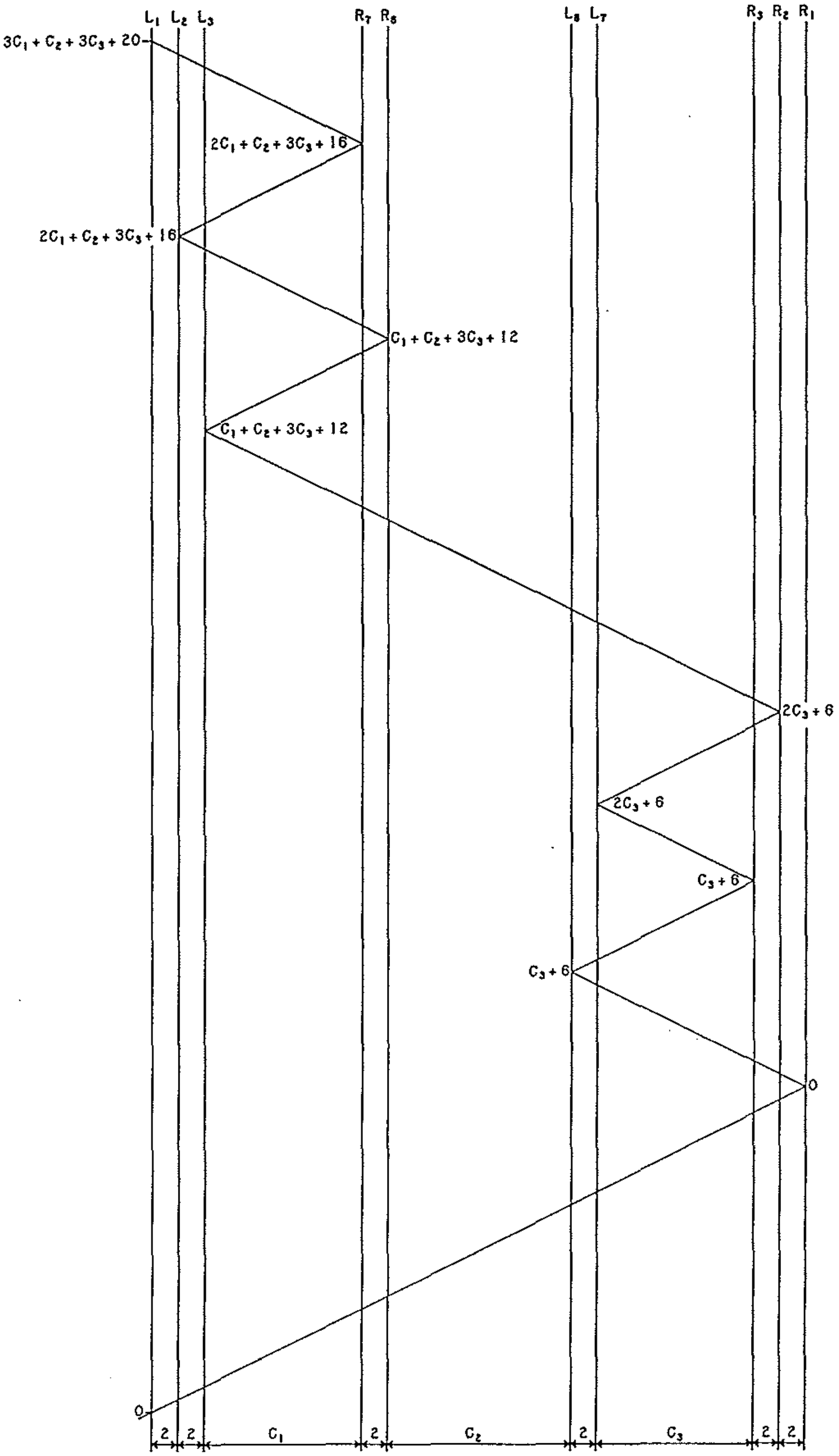

Fig. 1084 — The first-return string-run of the foundation knot.

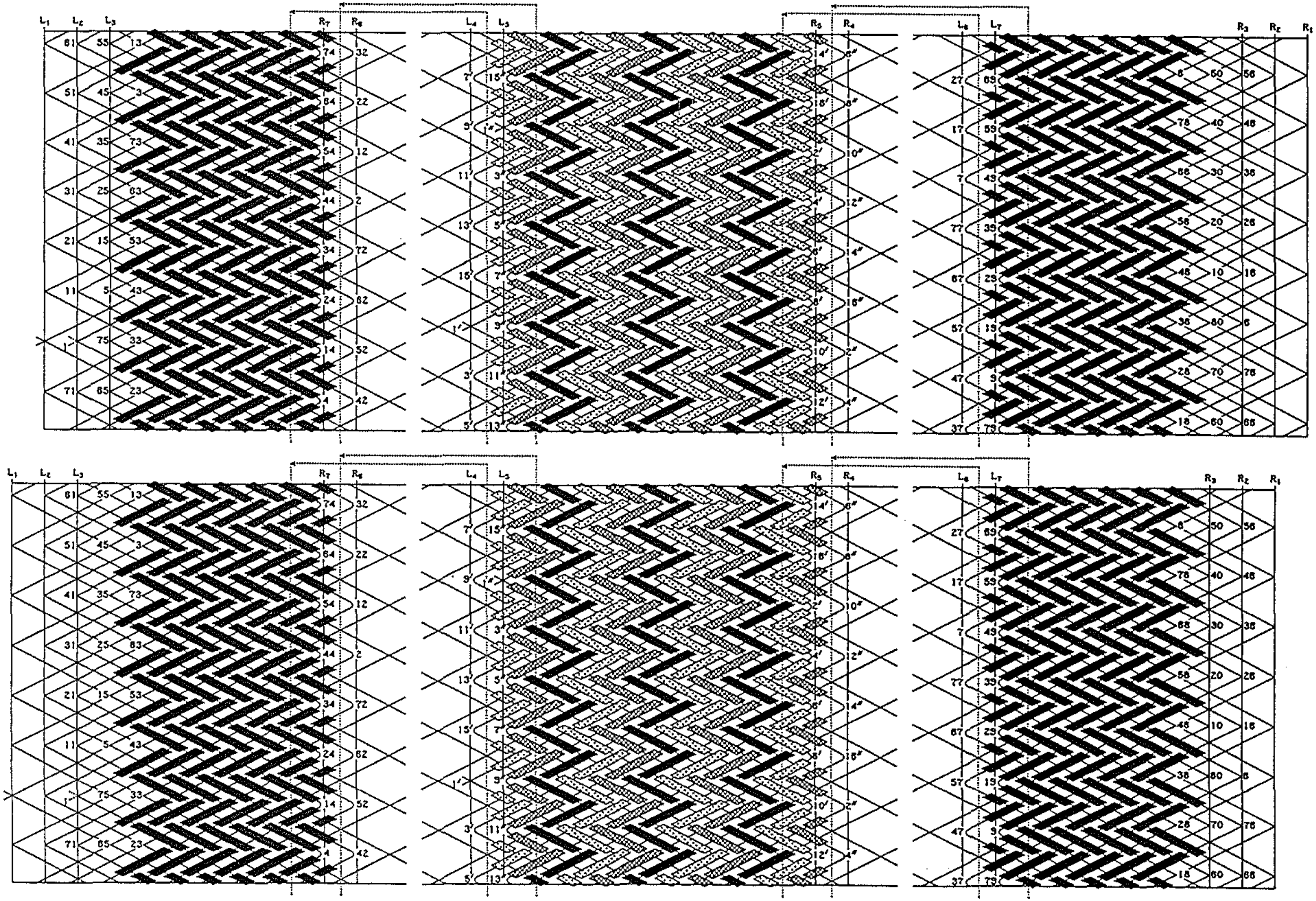

Fig. 1085 — See text pg. 1338.

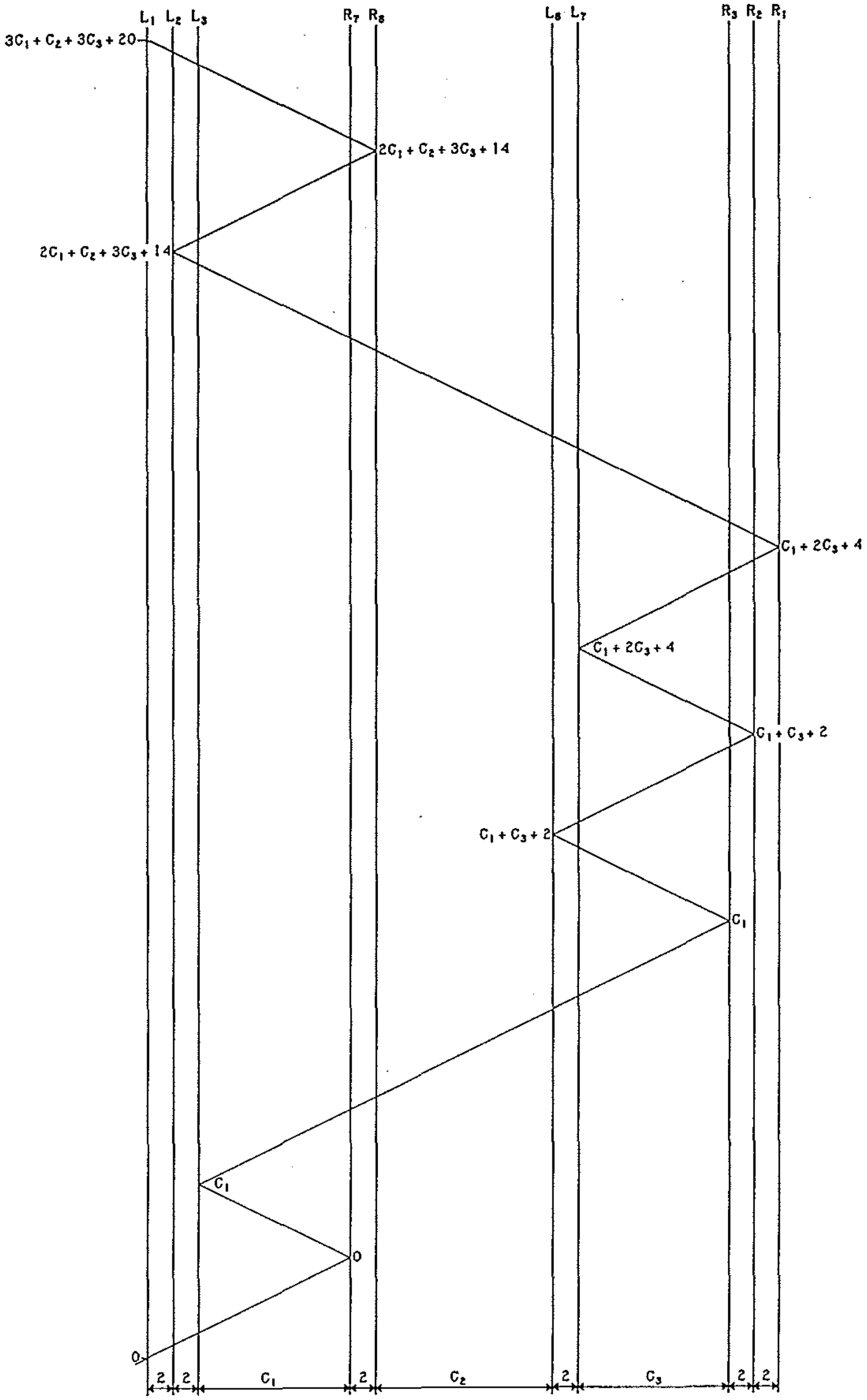

Fig. 1086 — The first-return string-run of the foundation knot.

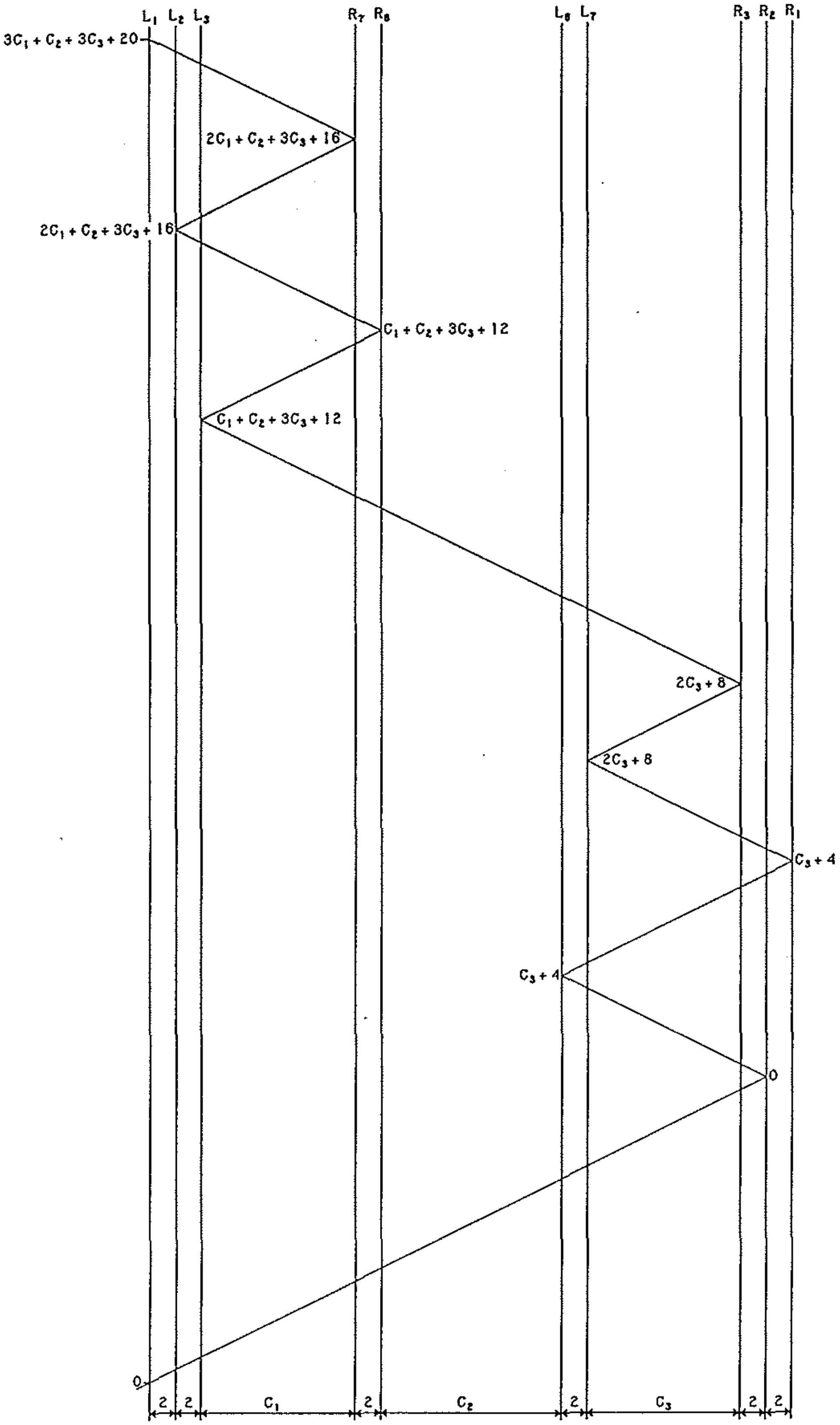

Fig. 1087 — The first-return string-run of the foundation knot.

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A quarterly publication
for
the braiding artisan

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A Braiding Project — A walking stick with knots

Many forms of walking sticks can be decorated with braided knots, but for this project we assume that the actual cane of the walking stick is of a slightly tapered cylindrical form with an upper diameter of approximately 25 mm. and lower diameter of approximately 19 mm. over a length of approximately 82 cm.. The walking stick we envisage here consists of four parts which screw together: the handle and a three section cane; this to enable easy transportation when required. The braiding material of various colours is braided synthetic round cord of 2 mm. diameter.

In this initial walking stick project we will use knots which can readily be braided to their weaving-pattern. There are four sets of Column-coded Regular Knots which lend themselves especially to weaving-pattern braiding:

i. The string-run is typified by $p = nb + 1$, where $nb = \alpha m$ (α-pass Regular Knot); n, α and , m are natural numbers.
ii. The string-run is typified by $p = nb - 1$, where $nb = \alpha m$ (α-pass Regular Knot); n, α and m are natural numbers.
iii. The string-run is typified by $p = nm + 1$, $b = nm - n + 1$ (n-pass Regular Knot); $n = \alpha$ and m are natural numbers.
iv. The string-run is typified by $p = nm + 1$, $b = nm + n + 1$ (n-pass Regular Knot); $n = \alpha$ and m are natural numbers.

set i:

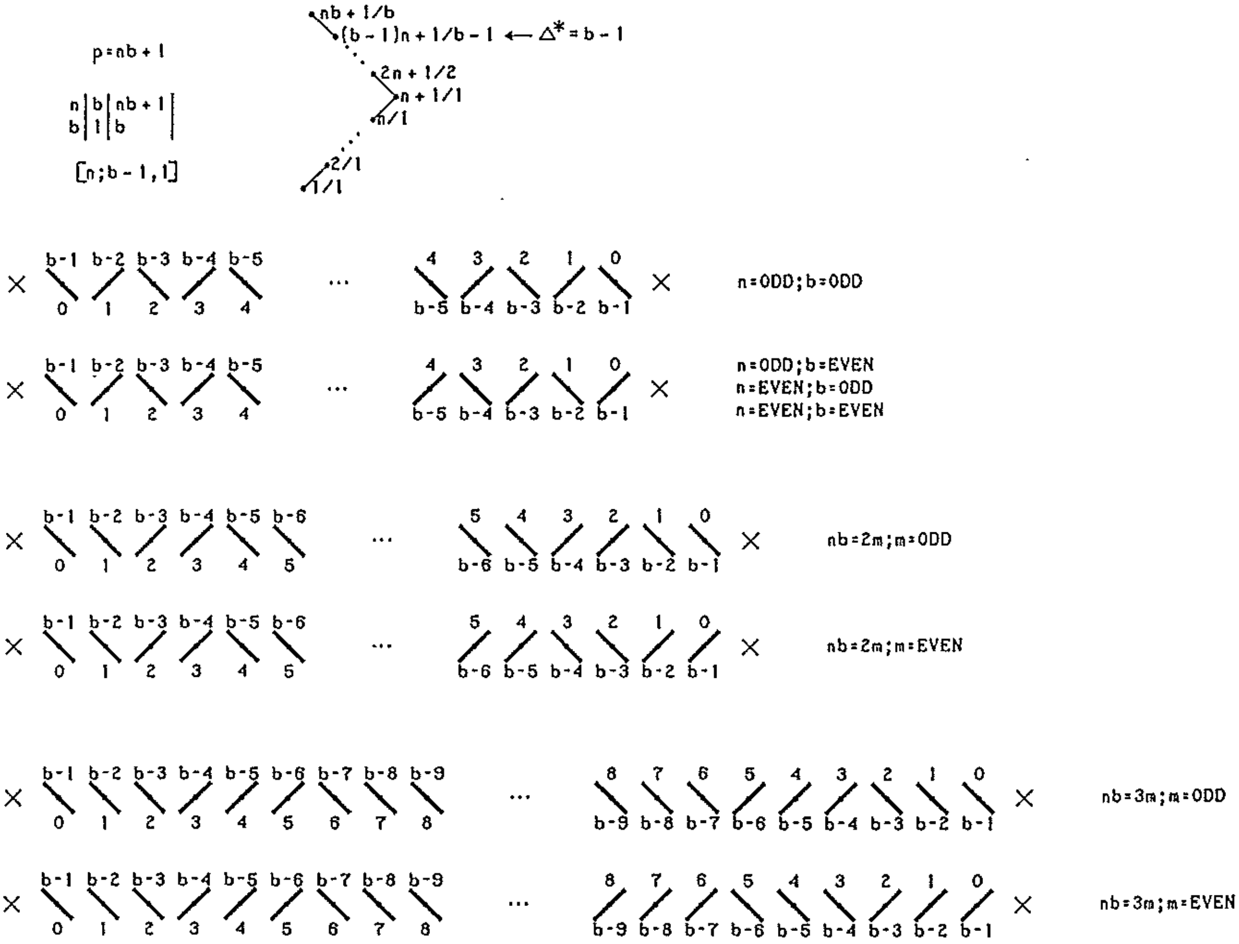


Fig. 1088 — Set **i** with $p = nb + 1$.

Most used by pattern-braiders is $n = 1$, thus $p = b + 1$. Since $nb = \alpha m$, it follows that $b = \alpha m$. The braiding sequence for $\alpha = 1$ is depicted in Fig. 1089; left of the vertical line for $b = m = odd$, and right of the vertical line for $b = m = even$. It shows that the pattern gets built up from the two bight-boundaries towards the centre.

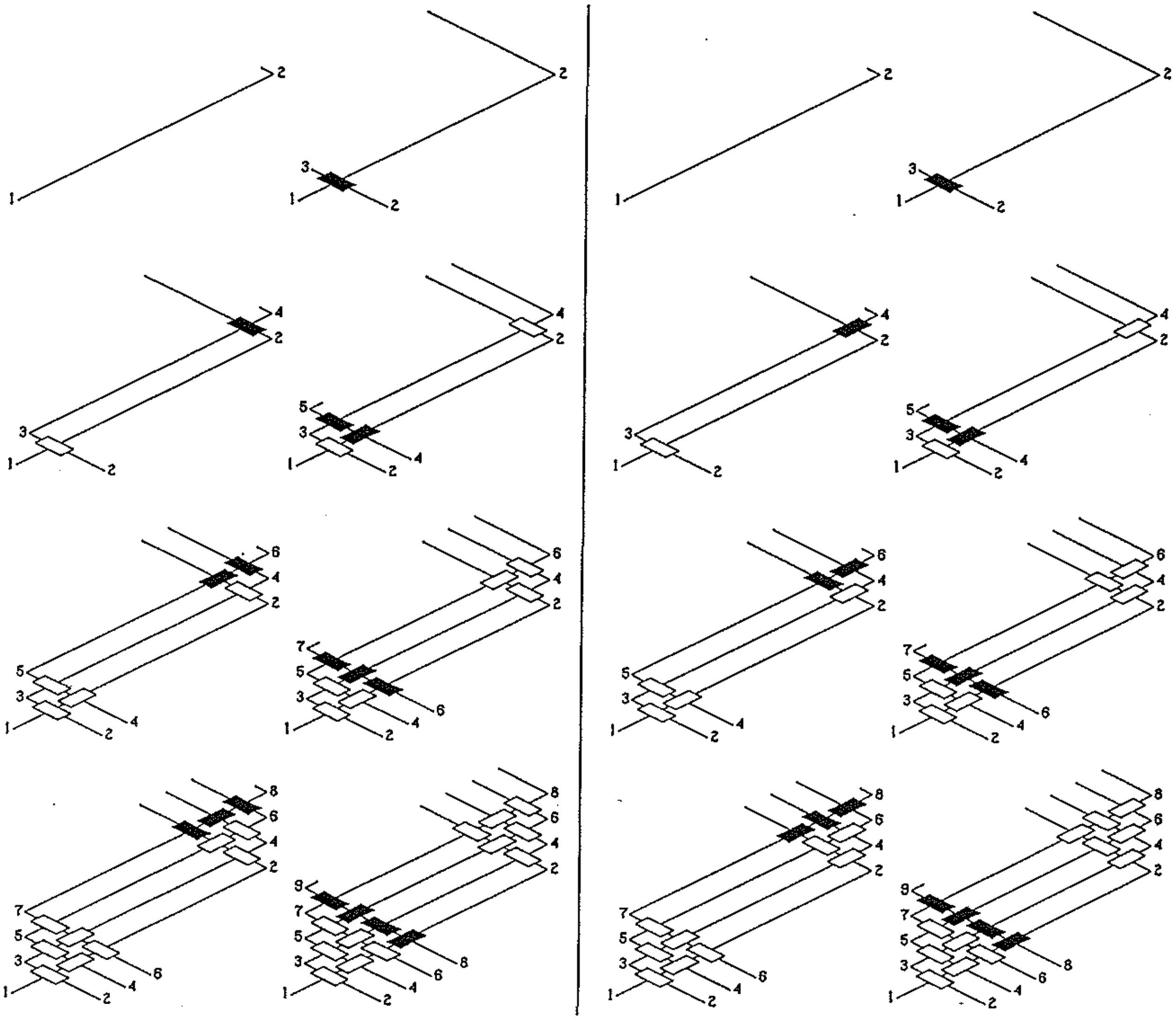


Fig. 1089 — Braiding sequences for $p = b + 1 = \alpha m + 1$, where $\alpha = 1$.

In addition to the pattern-building procedure from the two bight-boundaries towards the centre, there are, when $n > 1$, a further $n - 1$ equispaced positions between the two bight-boundaries from where pattern-building starts. These further $n - 1$ starting positions are the further crossings encountered by half-cycle 2. In order to get the codings at these further $n - 1$ pattern-building start-position correct we can make use of the tables in Fig. 1091 when $\alpha = 1$, the tables in Fig. 1092 when $\alpha = 2$, the tables in Fig. 1093 when $\alpha = 3$, and the tables in Fig. 1094 when $\alpha = 4$. Further tables can then be employed for further values of α. The general algorithm diagram, which displays one of such further $n - 1$ equispaced positions between the two bight-boundaries from where pattern-building starts, is depicted in Fig. 1090.

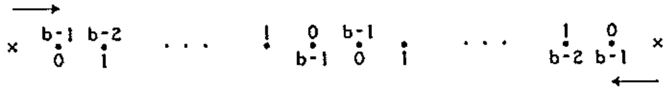


Fig. 1090 — One of the further $n - 1$ pattern-building centres.

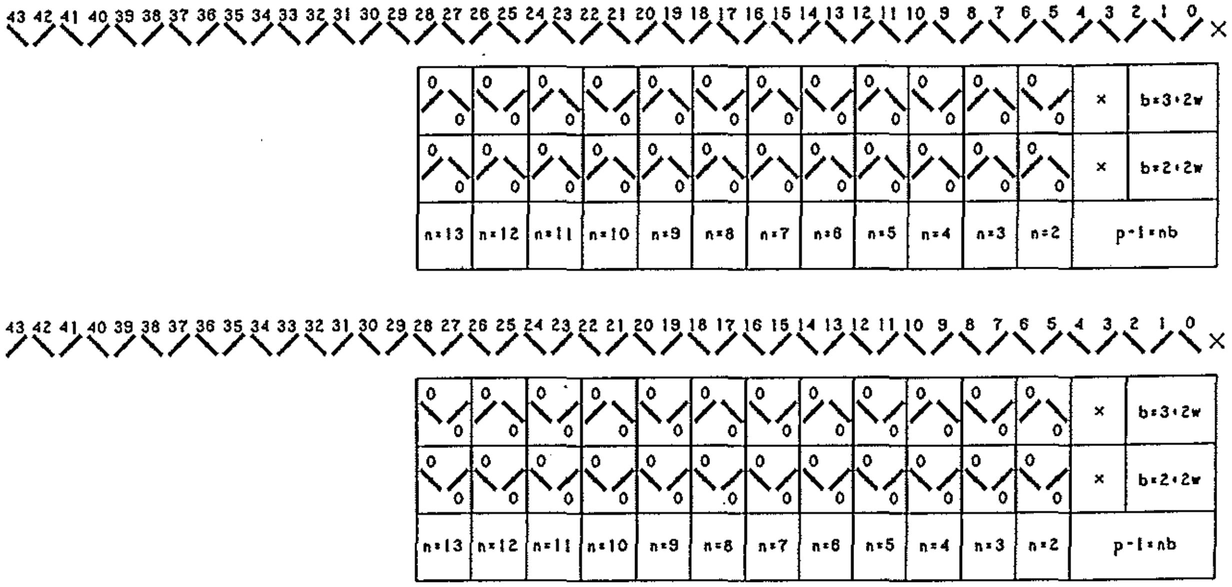


Fig. 1091 — Tables associated with $\alpha = 1$.

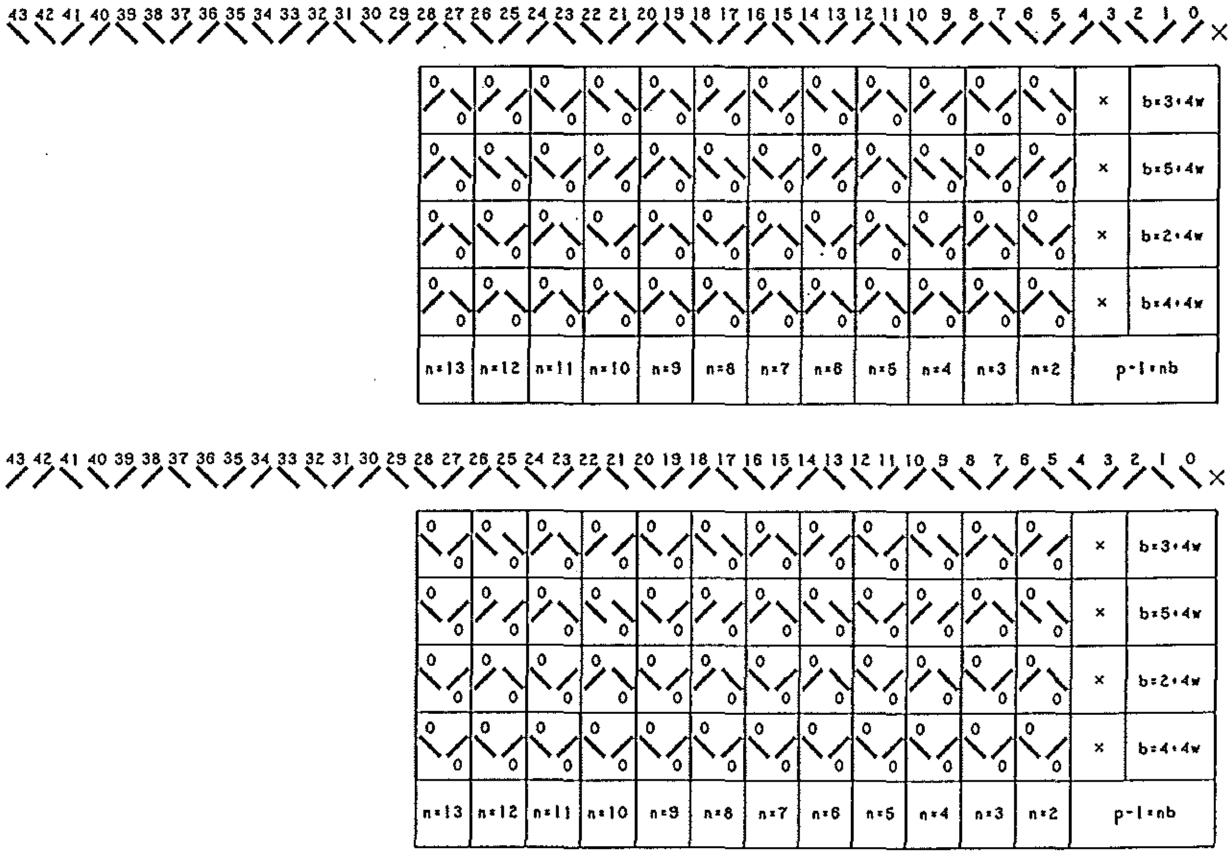


Fig. 1092 — Tables associated with $\alpha = 2$.

When $\alpha = 1$ or $\alpha = 2$ we require only the column-codings of the crossings encountered by the half-cycles 2 and 3 ($i = 0$) associated with the pattern-building centres additional to the $n = 1$ pattern-building sites; when $\alpha = 3$ we require not only the column-codings of the crossings encountered by the half-cycles 2 and 3 ($i = 0$), associated with the pattern-building centres additional to the $n = 1$ pattern-building sites, but also the column-codings of the crossings encountered by half-cycle 4 ($i \leq 1$) associated with the pattern-building centres additional to the $n = 1$ pattern-building sites; when $\alpha = 4$ we require the column-codings of the crossings encountered by the half-cycles 2, 3, 4 and 5 ($i \leq 1$) associated with the pattern-building centres additional to the $n = 1$ pattern-building sites; etc.

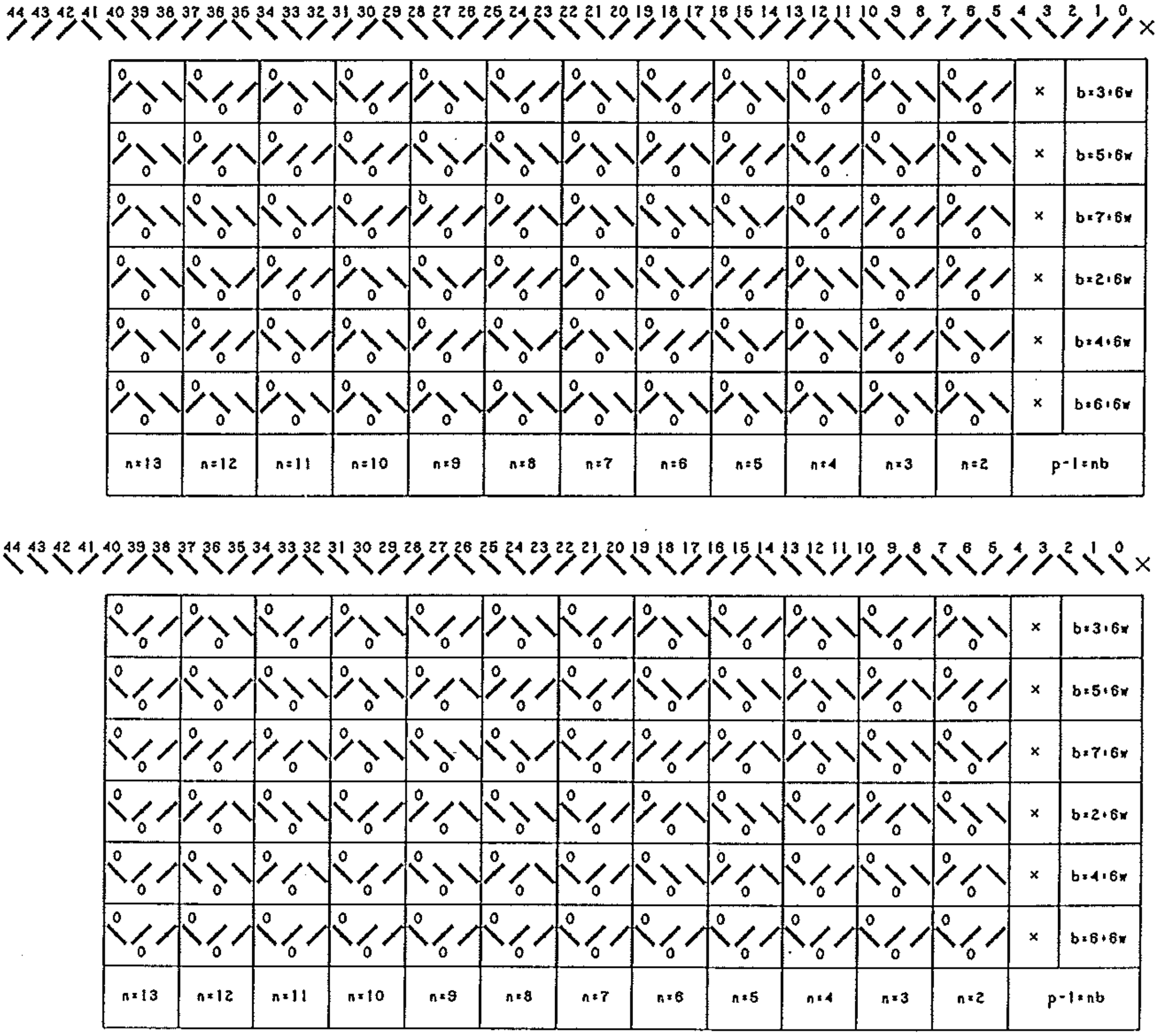


Fig. 1093 — Tables associated with $\alpha = 3$.

An example for $\alpha = 4$, $b = 12$, $n = 3$, with an over-crossing for the first crossing encountered by half-cycle 2, is shown in Fig. 1095. Since $m = 9 = odd$ ($nb = 3 \times 12 = 36 = \alpha m$), this 4-pass Regular Knot is a 4-pass Headhunter's knot.

We can either memorise the codings associated with the first five half-cycles as obtained from the lower table in Fig. 1094 (the relevant table section is shown at the upper-left in Fig. 1095) and displayed at the upper-right in Fig. 1095, or by braiding the first five half-cycles in accordance with this relevant table section as follows:

1. $L \longrightarrow R$: Free run.
2. $R \longrightarrow L$ $i = 0$: $o - u - o$.
3. $L \longrightarrow R$ $i = 0$: $u - o - u$.
4. $R \longrightarrow L$ $i = 1$: $2o - 2u - 2o$.
5. $L \longrightarrow R$ $i = 1$: $2u - 2o - 2u$.

The further 19 half-cycles can now readily be pattern braided.

Although it sufficient to establish the first three half-cycles in order to braid this knot by means pattern-braiding, in general this will not be sufficient (note from the tables in Fig. 1094 that for pattern-braiding the 4-pass Gaucho and Headhunter's knots with $n > 1$, the first three half-cycles only suffice when $b = 4 + 8w$ or $b = 8 + 8w$.

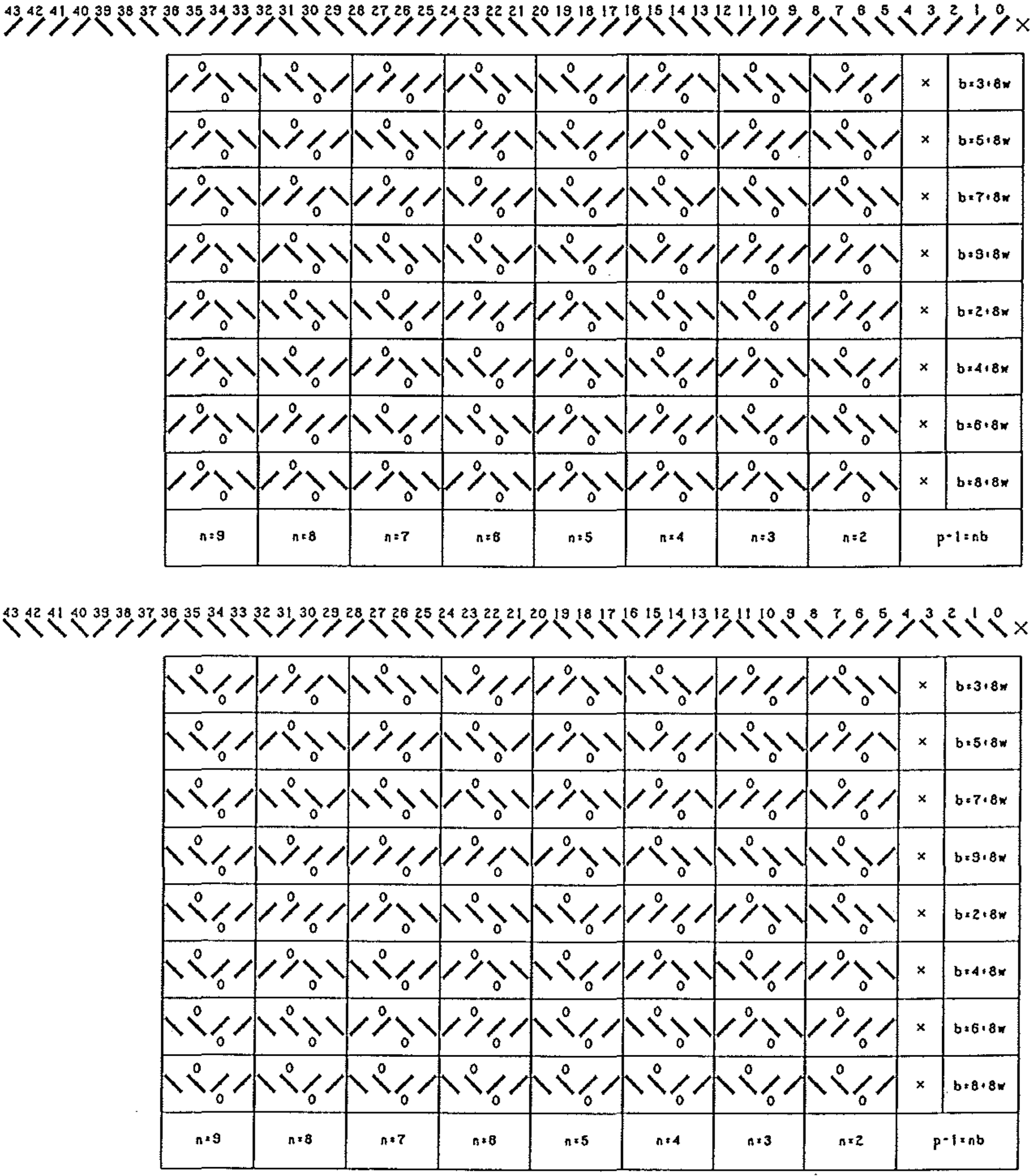


Fig. 1094 — Tables associated with $\alpha = 4$.

Note that the coding patterns of the $n-1$ pattern-building start-positions, additional to the $n = 1$ pattern-building sites, exhibit a periodic sequence. With $b = v + 2\alpha w$, where $2 \leq v \leq 2\alpha$ and w is a whole number, the periodic sequence of pattern-building start-positions, additional to the $n = 1$ pattern-building sites, consists of $\dfrac{2\alpha}{\text{g.c.d.}(v, 2\alpha)}$

consecutive coding patterns.

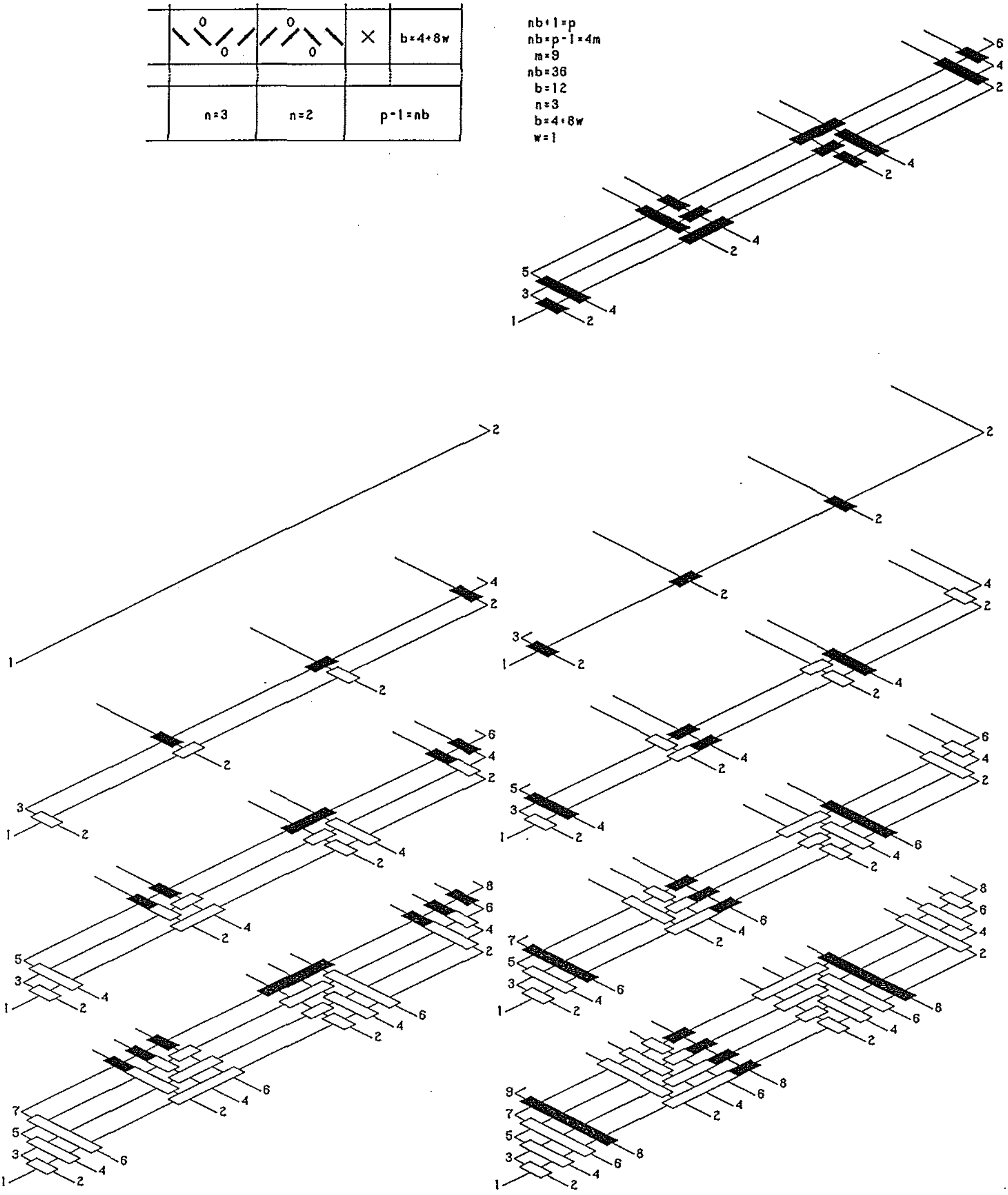


Fig. 1095 — $\alpha = 4$, $b = 12$, $n = 3$, first crossing by half-cycle 2 an over-crossing.

set ii :

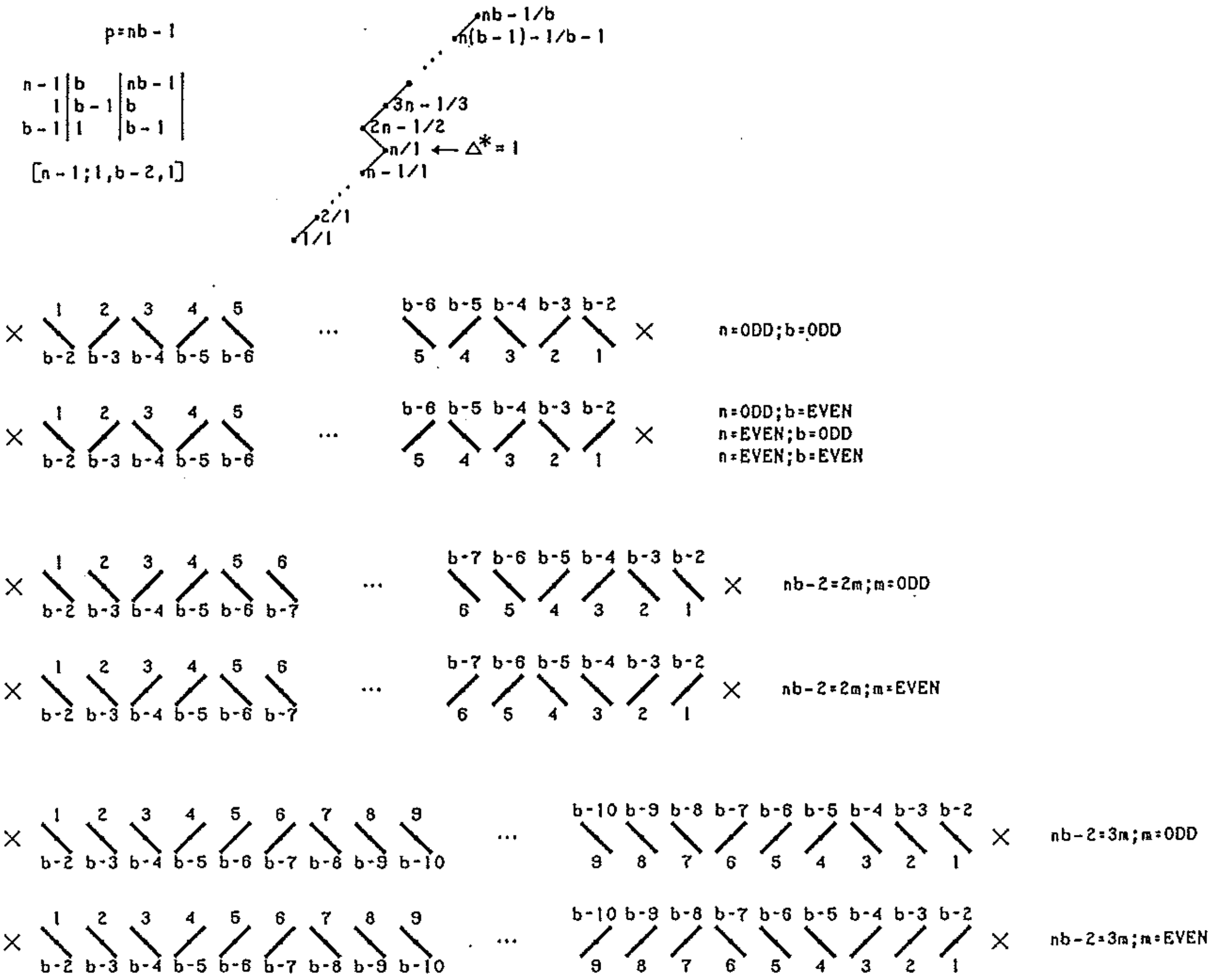


Fig. 1096 — Set **ii** with $p = nb - 1$.

Most used by pattern-braiders is $n = 1$, thus $p = b - 1$. Since $nb = \alpha m$, it follows that $b = \alpha m$. The braiding sequence for $\alpha = 1$ is depicted in Fig. 1098; left of the vertical line for $b = m = odd$, and right of the vertical line for $b = m = even$. It shows that the pattern gets built up from the two bight-boundaries towards the centre.

In addition to the pattern-building procedure from the two bight-boundaries towards the centre, there are, when $n > 1$, a further $n - 1$ equispaced positions between the two bight-boundaries from where pattern-building starts. These further $n - 1$ starting positions are the crossings encountered by half-cycle 2. In order to get the codings at these further $n - 1$ pattern-building start-position correct we can make use of the tables in Fig. 1099 when $\alpha = 1$, the tables in Fig. 1100 when $\alpha = 2$, the tables in Fig. 1101 when $\alpha = 3$, and the tables in Fig. 1102 when $\alpha = 4$. Further tables can then be employed for further values of α. The general algorithm diagram, which displays one of such further $n - 1$ equispaced positions between the two bight-boundaries from where pattern-building starts, is depicted in Fig. 1097.

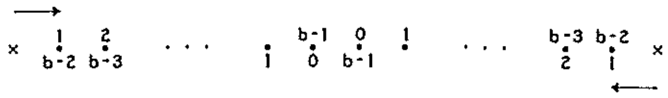


Fig. 1097 — One of the further $n - 1$ pattern-building centres.

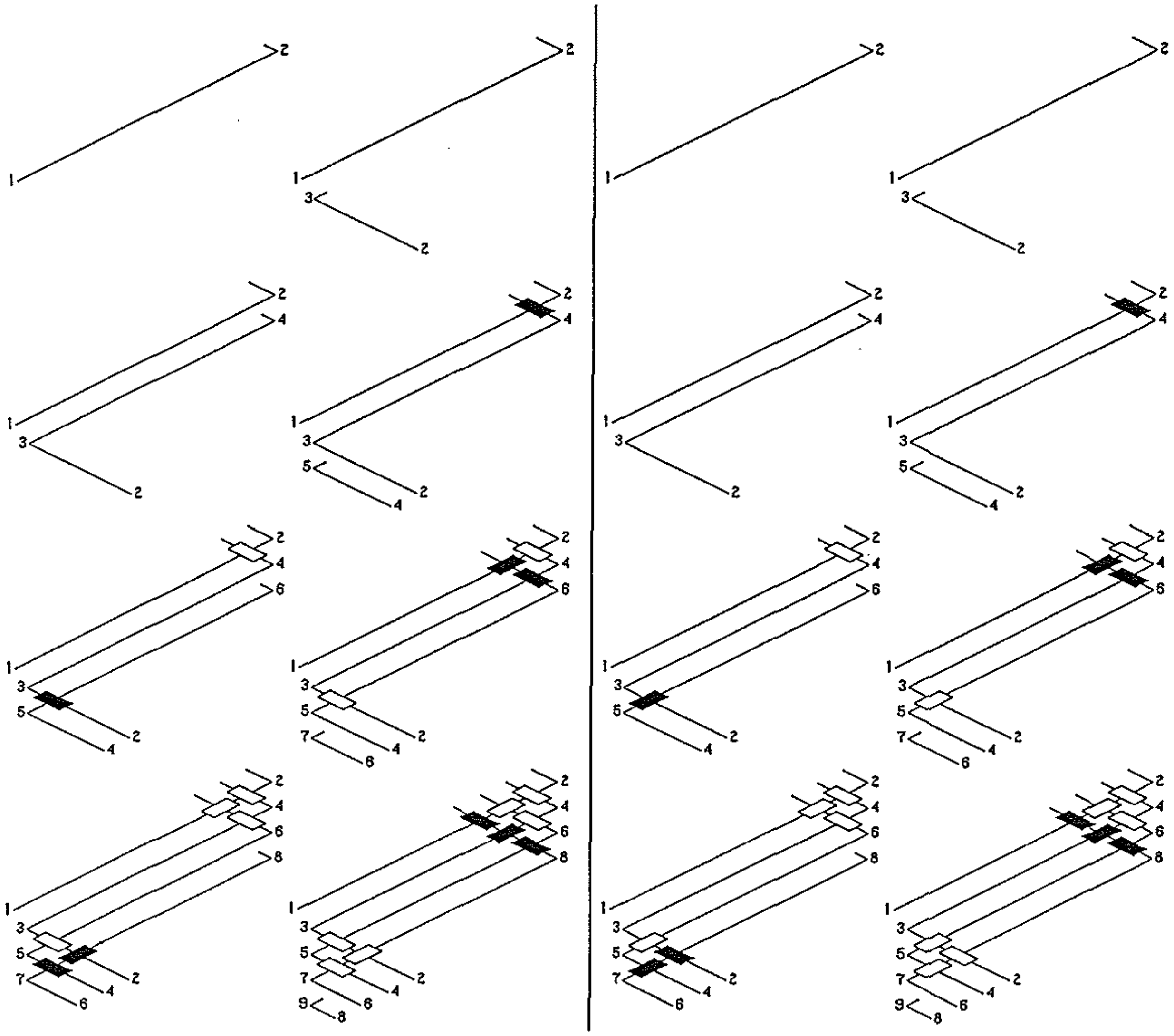


Fig. 1098 — Braiding sequences for $p = b - 1 = \alpha m - 1$, where $\alpha = 1$.

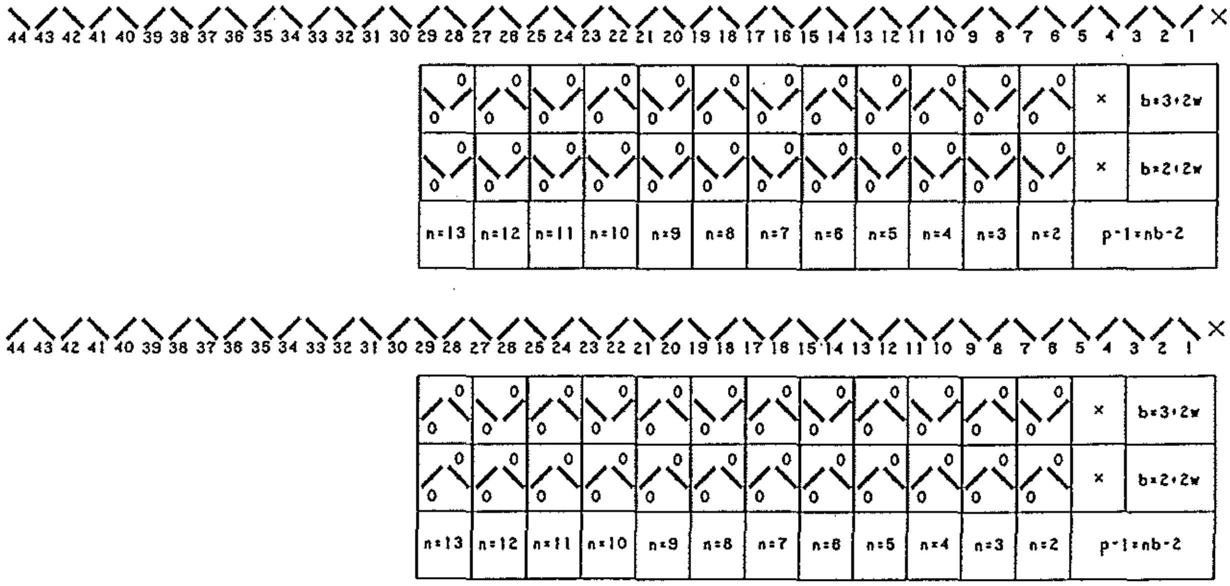


Fig. 1099 — Tables associated with $\alpha = 1$.

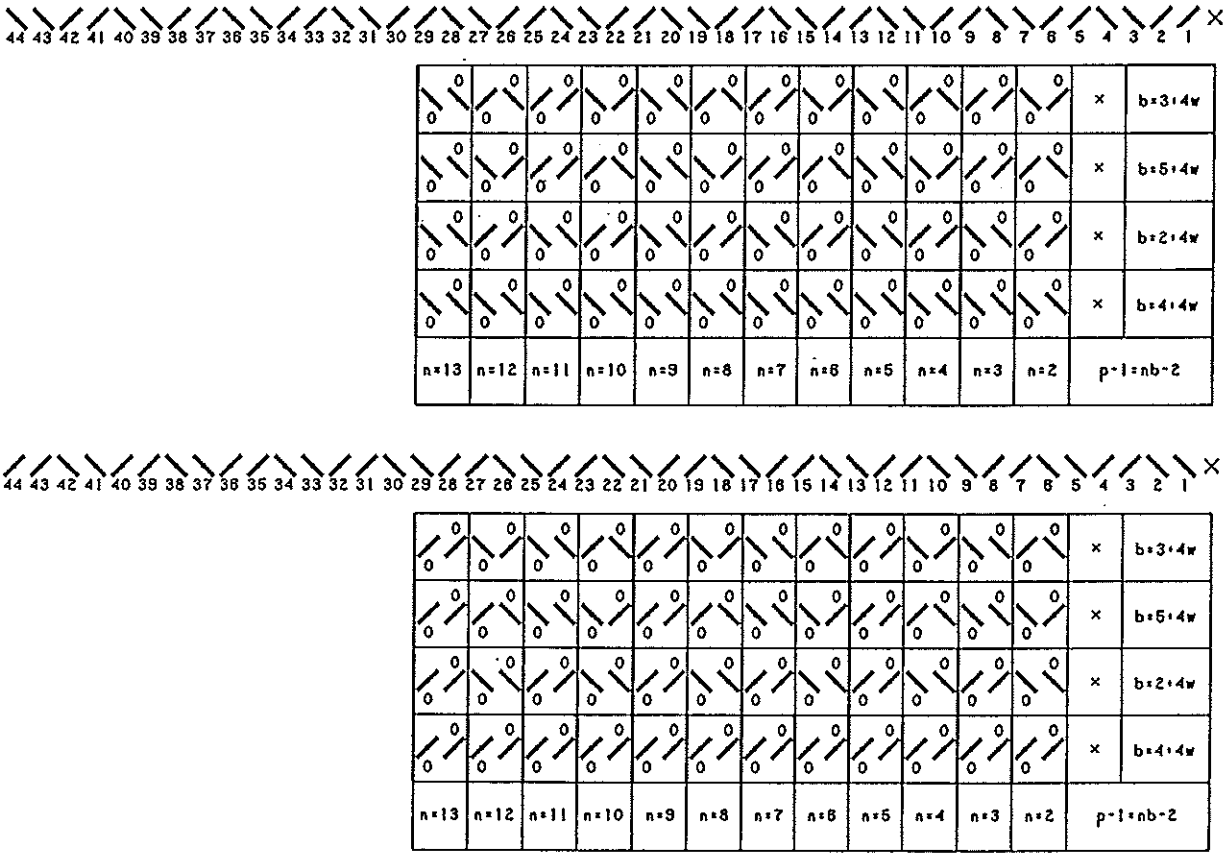


Fig. 1100 — Tables associated with $\alpha = 2$.

When $\alpha = 1$ or $\alpha = 2$ we require only the column-codings of the crossings encountered by the half-cycles 2 and 3 (hence associated with bight-number $i = 0$) associated with the pattern-building centres additional to the $n = 1$ pattern-building sites; when $\alpha = 3$ we require not only the column-codings of the crossings encountered by the half-cycles 2 and 3 (hence associated with bight-number $i = 0$), associated with the pattern-building centres additional to the $n = 1$ pattern-building sites but also the column-codings of the crossings encountered by half-cycle 4 (hence associated with the bight-numbers $i = 0$ and $i = 1$) associated with the pattern-building centres additional to the $n = 1$ pattern-building sites; when $\alpha = 4$ we require the column-codings of the crossings encountered by the half-cycles $2, 3, 4$ and 5 (hence associated with bight-numbers $i = 0$ and $i = 1$) associated with the pattern-building centres additional to the $n = 1$ pattern-building sites; etc.

An example for $\alpha = 4$, $b = 10$, $n = 3$, with an over-crossing for the first crossing encountered by half-cycle 2, is shown in Fig. 1103. Since $m = 7 =$ *odd* $(nb - 2 = 3 \times 10 - 2 = 30 - 2 = 28 = \alpha m)$, this 4-pass Regular Knot is a 4-pass Headhunter's knot.

We can either again memorise the codings associated with the first five half-cycles as obtained from the lower table in Fig. 1102 (the relevant table section is shown at the upper-left in Fig. 1103) and displayed at the upper-right in Fig. 1103, or by braiding the first five half-cycles in accordance with this relevant table section as follows:

1. $L \longrightarrow R$: Free run.
2. $R \longrightarrow L$ $i = 0$: $2o$.

3. $L \longrightarrow R$ $i = 0$: $2u$.
4. $R \longrightarrow L$ $i = 1$: $4o - u$.
5. $L \longrightarrow R$ $i = 1$: $4u - o$.

The further 15 half-cycles can now readily be pattern braided.

Note that we do require here the first five half-cycles for establishing the braid-pattern at the $n-1$ pattern-braiding centres additional to the $n=1$ pattern-building sites. Note furthermore from the tables in Fig. 1102 that for pattern-braiding the 4-pass Gaucho and Headhunter's knots there are no b-values for which the first three half-cycles are sufficient for establishing the braid-pattern at the $n-1$ pattern-braiding centres, additional to the $n=1$ pattern-building sites, when $n > 2$. For pattern-braiding the 4-pass Gaucho and Headhunter's knots, the first three half-cycles are only sufficient for establishing the braid-pattern at the $n-1=1$ pattern-braiding centre (hence when $n=2$), additional to the $n=1$ pattern-building sites, for $b = 5 + 8w$ and $b = 9 + 8w$, where w is a whole number.

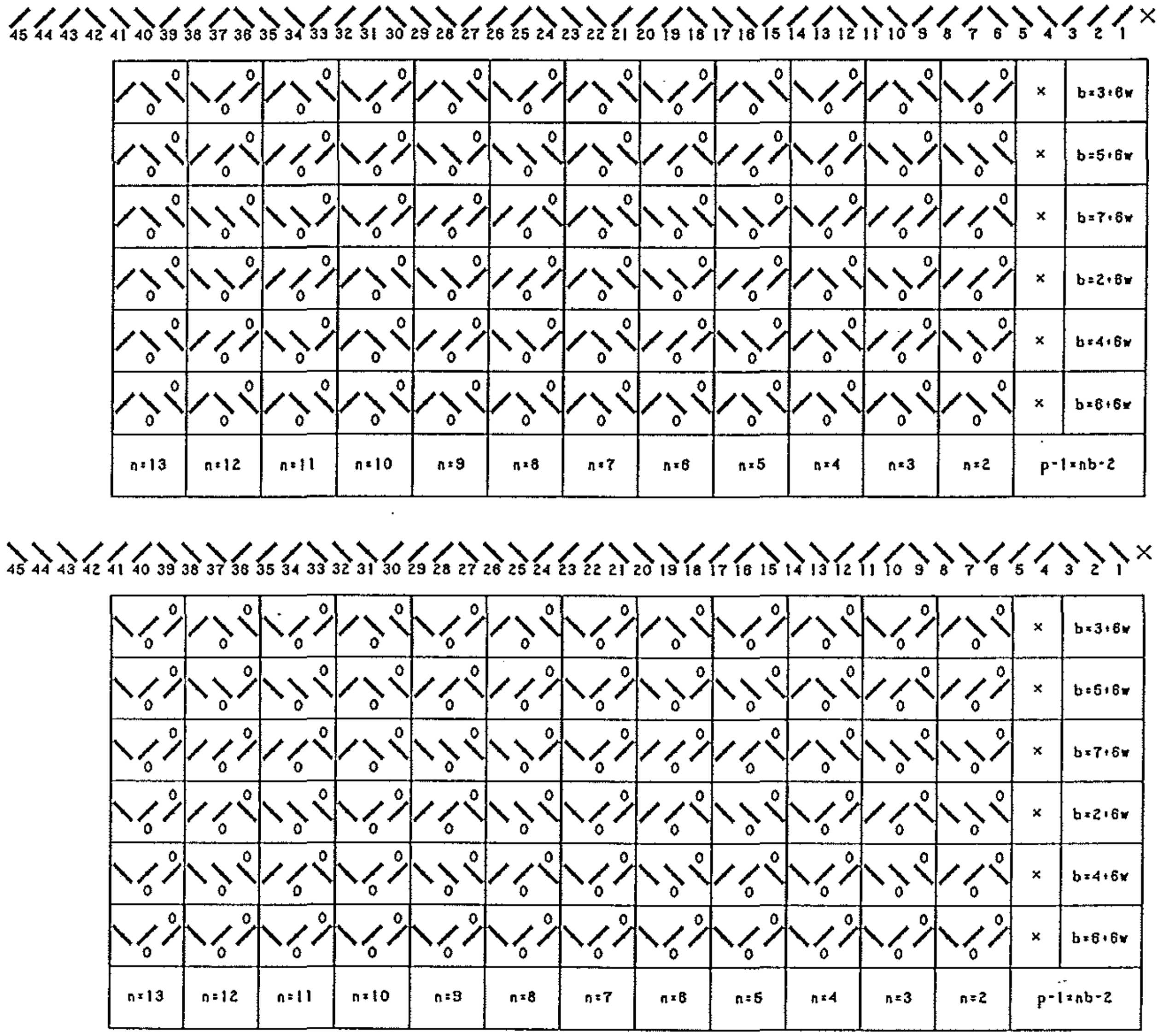


Fig. 11101 — Tables associated with $\alpha = 3$.

The coding patterns of the $n-1$ pattern-building start-positions, additional to the $n=1$ pattern-building sites, exhibit again a periodic sequence. With $b = v + 2\alpha w$, where $2 \leq v \leq 2\alpha$ and w is a whole number, the periodic sequence of pattern-building start-positions, additional to the $n = 1$ pattern-building sites[†], consists of $\dfrac{2\alpha}{\text{g.c.d.}(v, 2\alpha)}$ consecutive coding patterns.

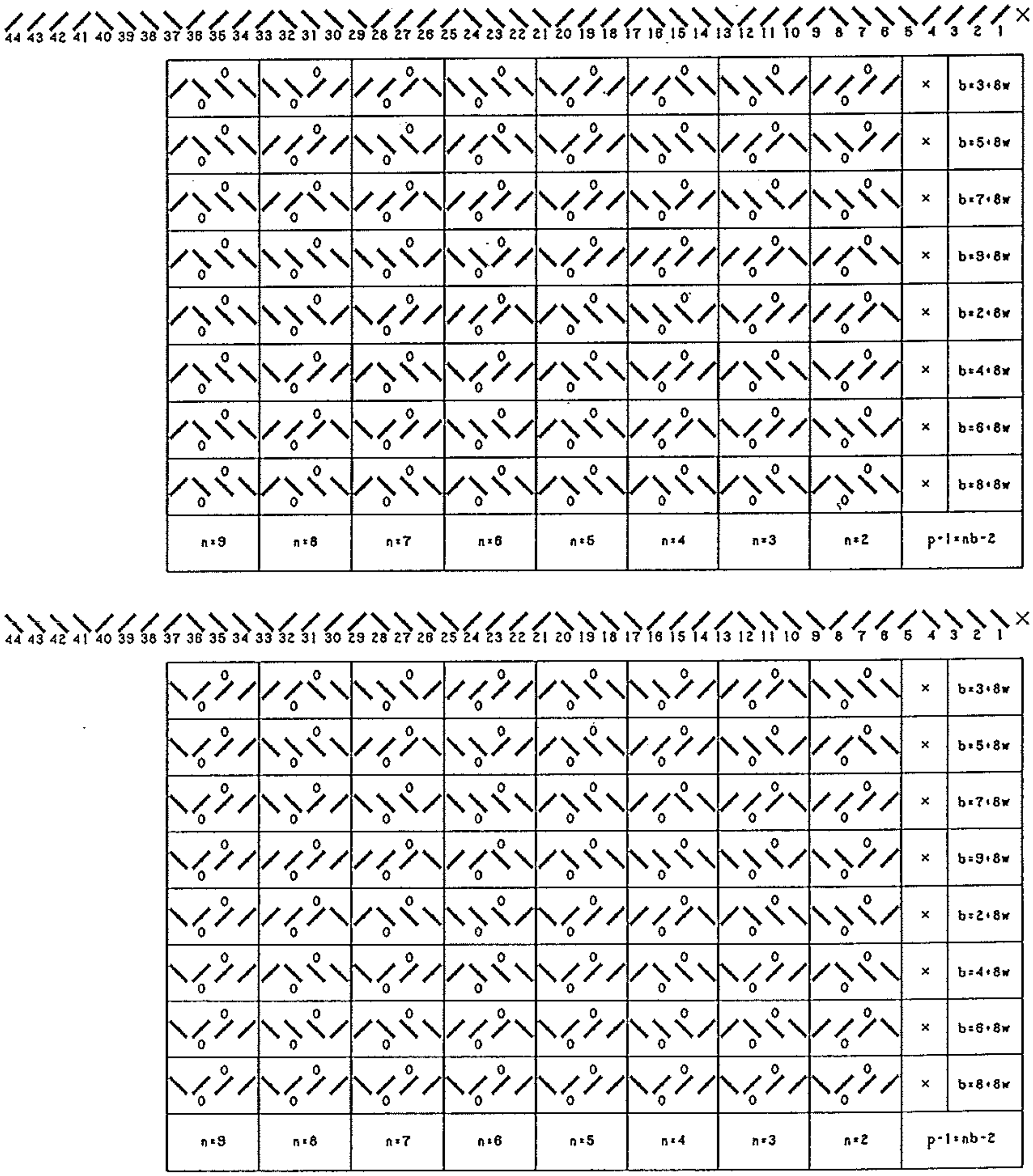


Fig. 1102 — Tables associated with $\alpha = 4$.

An example of a 4-pass Headhunter's knot with $m = 7$, and $n = 3$ hence with $\alpha m = 4 \times 7 = 28$ and $b = \dfrac{\alpha m + 2}{n} = \dfrac{28 + 2}{3} = 10$ is shown in Fig. 1103.

[†] The $n = 1$ pattern-building sites are the two sites, one at the left-hand bight-boundary and one at the right-hand bight-boundary.

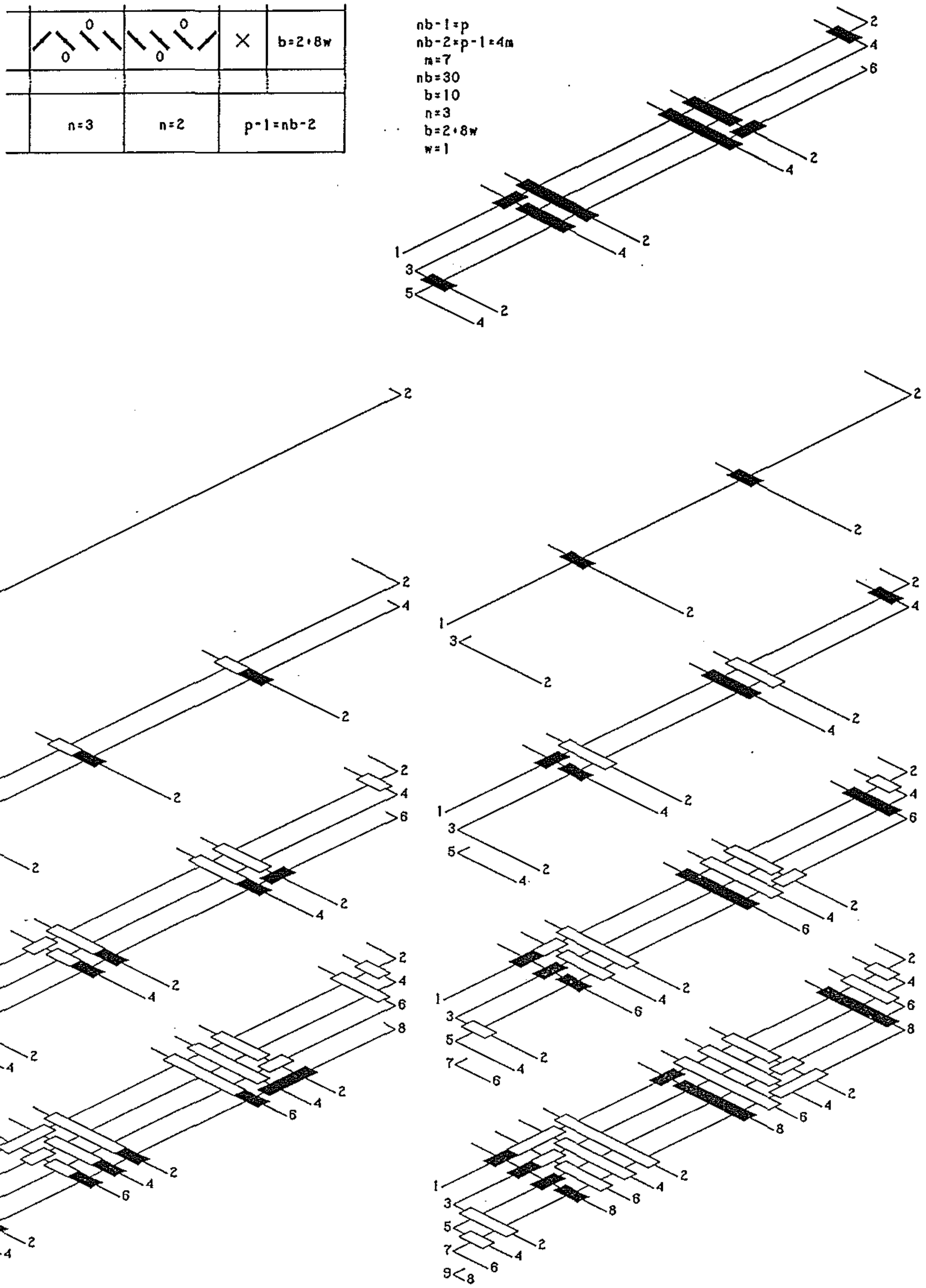


Fig. 1103 — $\alpha = 4$, $b = 10$, $m = 7$, first crossing by half-cycle 2 an over-crossing.

set iii :

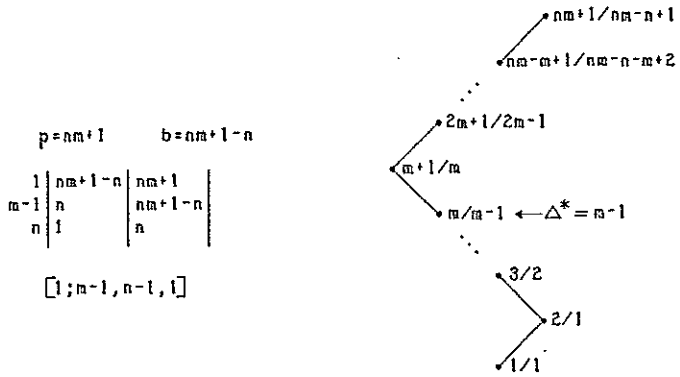


Fig. 1104 — $p = nm + 1$, $b = nm - n + 1$, hence $\Delta^* = m - 1$.

With Euclid's algorithm we obtain the path-formula $[1; m-1, n-1, 1]$ of $p/b = nm + 1/nm - n + 1$ in the RKT and from the path in the RKT we obtain $\Delta^* = m - 1$. See Fig. 1104. Hence $\Delta^* = \dfrac{b-1}{n}$. Consequently $|n\Delta^*|_b = |b-1|_b = b - 1$.

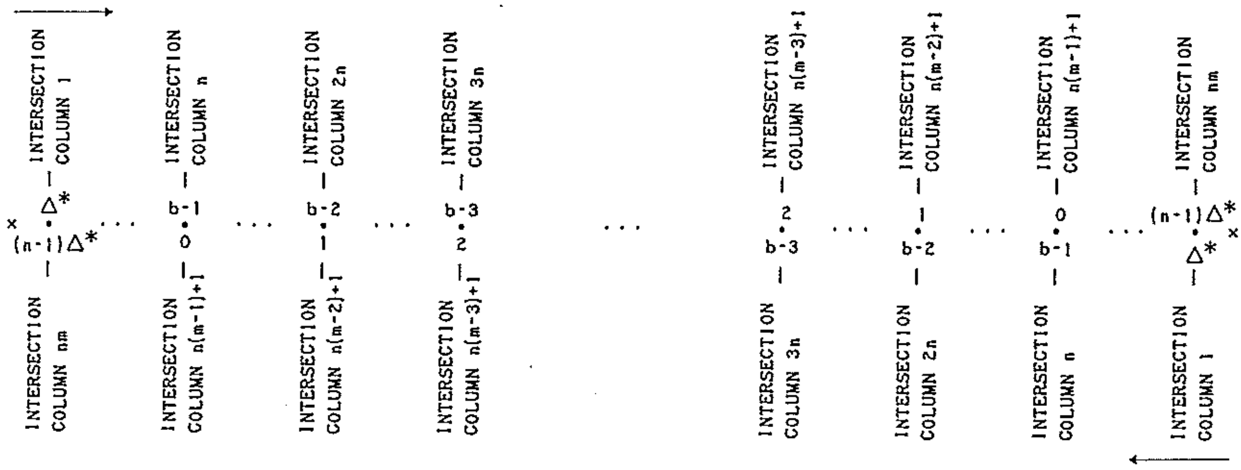


Fig. 1105 — The general layout of the algorithm diagram.

The general layout of the associated algorithm diagram is depicted in Fig. 1105. The intersection-columns, indicated by the dots, can be given an α-pass coding, where $\alpha = n$. Examples for $\alpha = n$ equal 1, 2, 3 and 4 are shown in Fig. 1106.

The braiding of such an α-pass column-coded Regular Knot consists of $n = \alpha$ stages: the first stage produces a $p/b = m + 1/m$ under-over coded Regular Knot (a one-pass Regular Knot), the second stage transforms this $p/b = m + 1/m$ under-over coded Regular Knot into a $p/b = 2m + 1/2m - 1$ two-pass Regular Knot, the third stage transforms this $p/b = 2m+1/2m-1$ two-pass Regular Knot into a $p/b = 3m+1/3m-2$ three-pass Regular Knot, the fourth stage transforms this $p/b = 3m + 1/3m - 2$ three-pass Regular Knot into a $p/b = 4m + 1/4m - 3$ four-pass Regular Knot, and so on.

Note that the first stage is **set i** with $n = 1$ and $nb = b = \alpha m = m$. See the upper two algorithm diagrams in Fig. 1106.

The first stage has been completed after half-cycle $2\Delta^* + 2 = 2m$ has been laid down up to the Standing End (half-cycle $2\Delta^* + 2 = 2m$ reaches the Standing End at the lower left-hand Δ^*-crossing in the algorithm diagrams of Fig. 1107).

The second stage starts at the end of half-cycle $2\Delta^* + 2 = 2m$ with an over-crossing on the Standing End and ends when half-cycle $4\Delta^* + 2 = 4m - 2$ reaches the lower left-hand $2\Delta^*$-crossing. The odd-numbered half-cycles in this stage build the 2-pass pattern sequence from the right-hand bight-boundary towards the left-hand bight-boundary and start from the left-hand bight-boundary with the crossings sequence $u - o - \cdots$ till the 2-pass pattern sequence has been reached. The even-numbered half-cycles in this stage build the 2-pass pattern sequence from the left-hand bight-boundary towards the right-hand bight-boundary and start from the right-hand bight-boundary with the crossings sequence $o - u - \cdots$ when $m = odd$ or $u - o - \cdots$ when $m = even$ till the 2-pass pattern sequence has been reached.

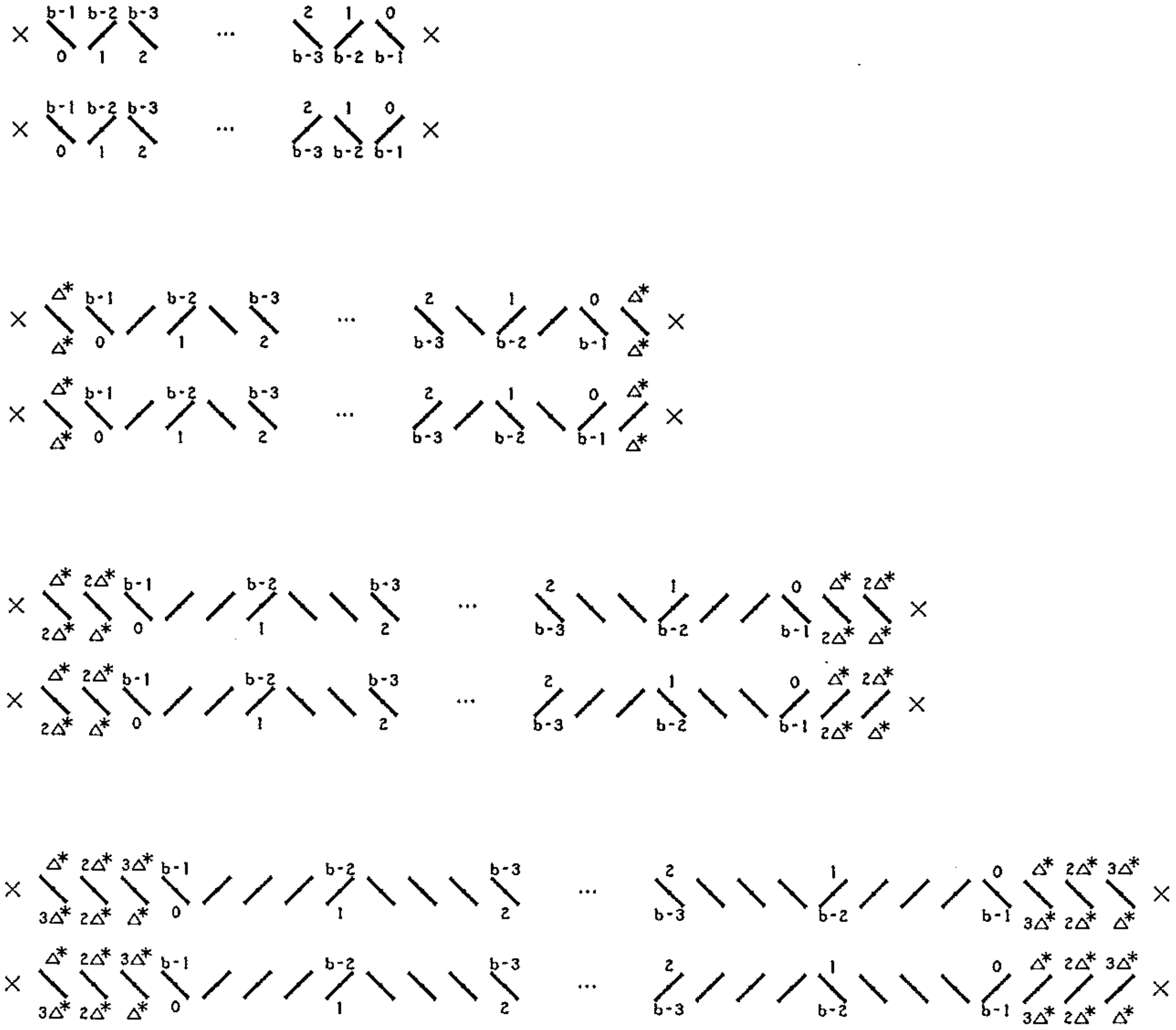
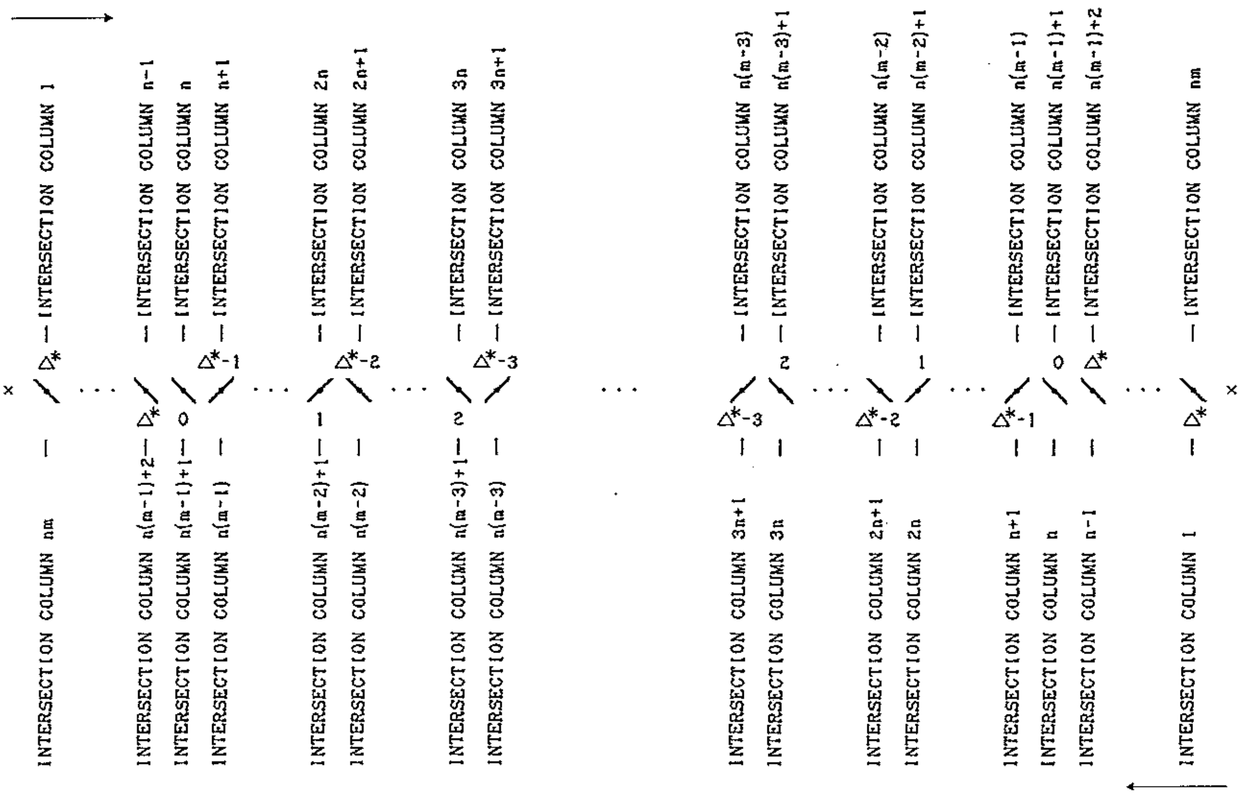


Fig. 1106 — **set iii** with $\alpha = 1\,, 2\,, 3$ and 4.

The third stage starts at the end of half-cycle $4\Delta^* + 2 = 4m - 2$ with an over-crossing on the Standing End and ends when half-cycle $6\Delta^* + 2 = 6m - 4$ reaches the lower left-hand $3\Delta^*$-crossing. The odd-numbered half-cycles in this stage build the 3-pass pattern sequence from the right-hand bight-boundary towards the left-hand bight-boundary and start from the left-hand bight-boundary with the crossings sequence $2u - 2o - \cdots$ till the 3-pass pattern sequence has been reached. The even-numbered half-cycles in this stage build the 3-pass pattern sequence from the left-hand bight-boundary towards the right-hand bight-boundary and start from the right-hand bight-boundary with the crossings sequence $2o - 2u - \cdots$ when $m = odd$ or $2u - 2o - \cdots$ when $m = even$ till the 3-pass pattern sequence has been reached.

And so on.


INTERSECTION COLUMN nm — INTERSECTION COLUMN 1
INTERSECTION COLUMN n(m-1)+2 — INTERSECTION COLUMN n-1
INTERSECTION COLUMN n(m-1)+1 — 0 — INTERSECTION COLUMN n
INTERSECTION COLUMN n(m-1) — INTERSECTION COLUMN n+1
INTERSECTION COLUMN n(m-2)+1 — 1 — INTERSECTION COLUMN 2n
INTERSECTION COLUMN n(m-2) — INTERSECTION COLUMN 2n+1
INTERSECTION COLUMN n(m-3)+1 — 2 — INTERSECTION COLUMN 3n
INTERSECTION COLUMN n(m-3) — INTERSECTION COLUMN 3n+1
INTERSECTION COLUMN 3n+1 — INTERSECTION COLUMN n(m-3)
INTERSECTION COLUMN 3n — 2 — INTERSECTION COLUMN n(m-3)+1
INTERSECTION COLUMN 2n+1 — INTERSECTION COLUMN n(m-2)
INTERSECTION COLUMN 2n — 1 — INTERSECTION COLUMN n(m-2)+1
INTERSECTION COLUMN n+1 — INTERSECTION COLUMN n(m-1)
INTERSECTION COLUMN n — 0 — INTERSECTION COLUMN n(m-1)+1
INTERSECTION COLUMN n-1 — INTERSECTION COLUMN n(m-1)+2
INTERSECTION COLUMN 1 — INTERSECTION COLUMN nm
×
Δ*
Δ*-1
Δ*-2
Δ*-3

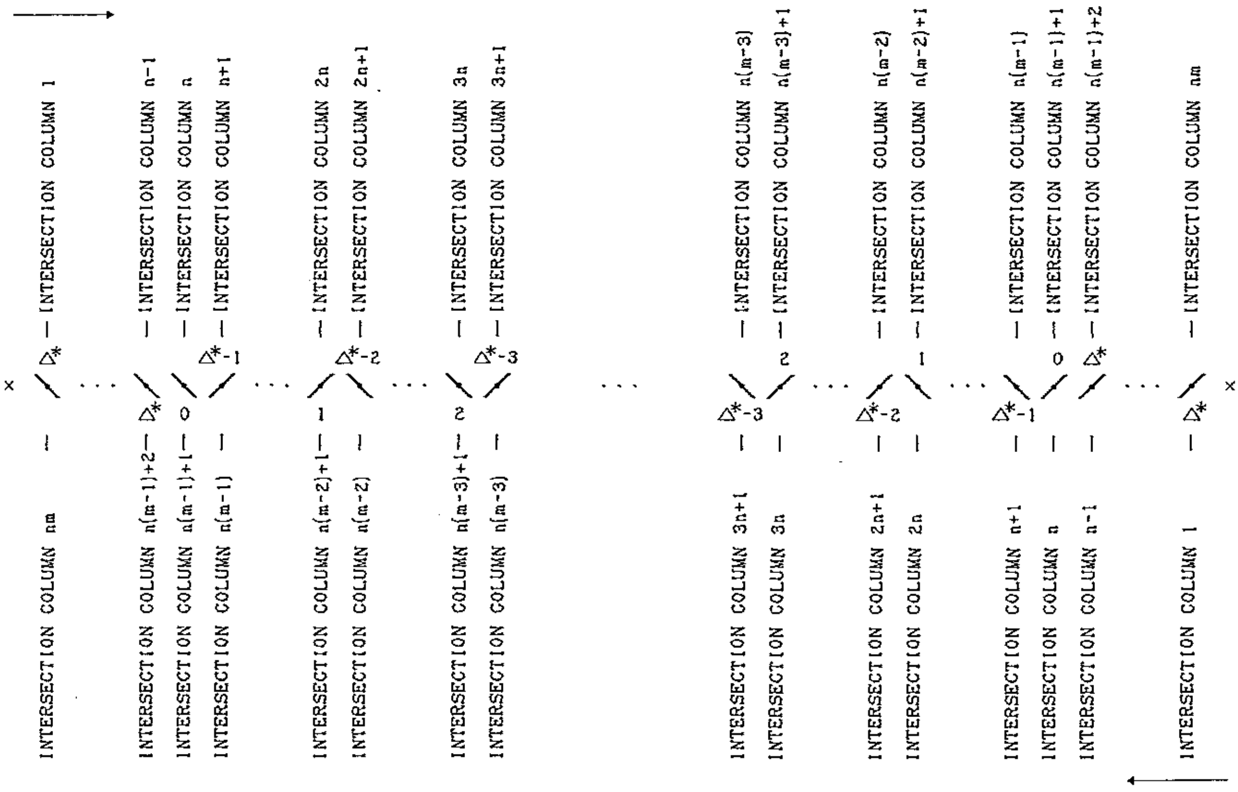

INTERSECTION COLUMN nm — INTERSECTION COLUMN 1
INTERSECTION COLUMN n(m-1)+2 — INTERSECTION COLUMN n-1
INTERSECTION COLUMN n(m-1)+1 — 0 — INTERSECTION COLUMN n
INTERSECTION COLUMN n(m-1) — INTERSECTION COLUMN n+1
INTERSECTION COLUMN n(m-2)+1 — 1 — INTERSECTION COLUMN 2n
INTERSECTION COLUMN n(m-2) — INTERSECTION COLUMN 2n+1
INTERSECTION COLUMN n(m-3)+1 — 2 — INTERSECTION COLUMN 3n
INTERSECTION COLUMN n(m-3) — INTERSECTION COLUMN 3n+1
INTERSECTION COLUMN 3n+1 — INTERSECTION COLUMN n(m-3)
INTERSECTION COLUMN 3n — 2 — INTERSECTION COLUMN n(m-3)+1
INTERSECTION COLUMN 2n+1 — INTERSECTION COLUMN n(m-2)
INTERSECTION COLUMN 2n — 1 — INTERSECTION COLUMN n(m-2)+1
INTERSECTION COLUMN n+1 — INTERSECTION COLUMN n(m-1)
INTERSECTION COLUMN n — 0 — INTERSECTION COLUMN n(m-1)+1
INTERSECTION COLUMN n-1 — INTERSECTION COLUMN n(m-1)+2
INTERSECTION COLUMN 1 — INTERSECTION COLUMN nm
×
Δ*
Δ*-1
Δ*-2
Δ*-3

Fig. 1107 — Towards the end of the first stage, start of the second stage.

Fig. 1108 shows an example where $n = 3$, $m = 7$. The bold half-cycles in the upper string-run diagram are the half-cycles in the first stage. The bold half-cycles in the lower string-run diagram are the half-cycles in the first and second stage. The dotted half-cycles in the lower string-run diagram are the further half-cycles in the third stage.

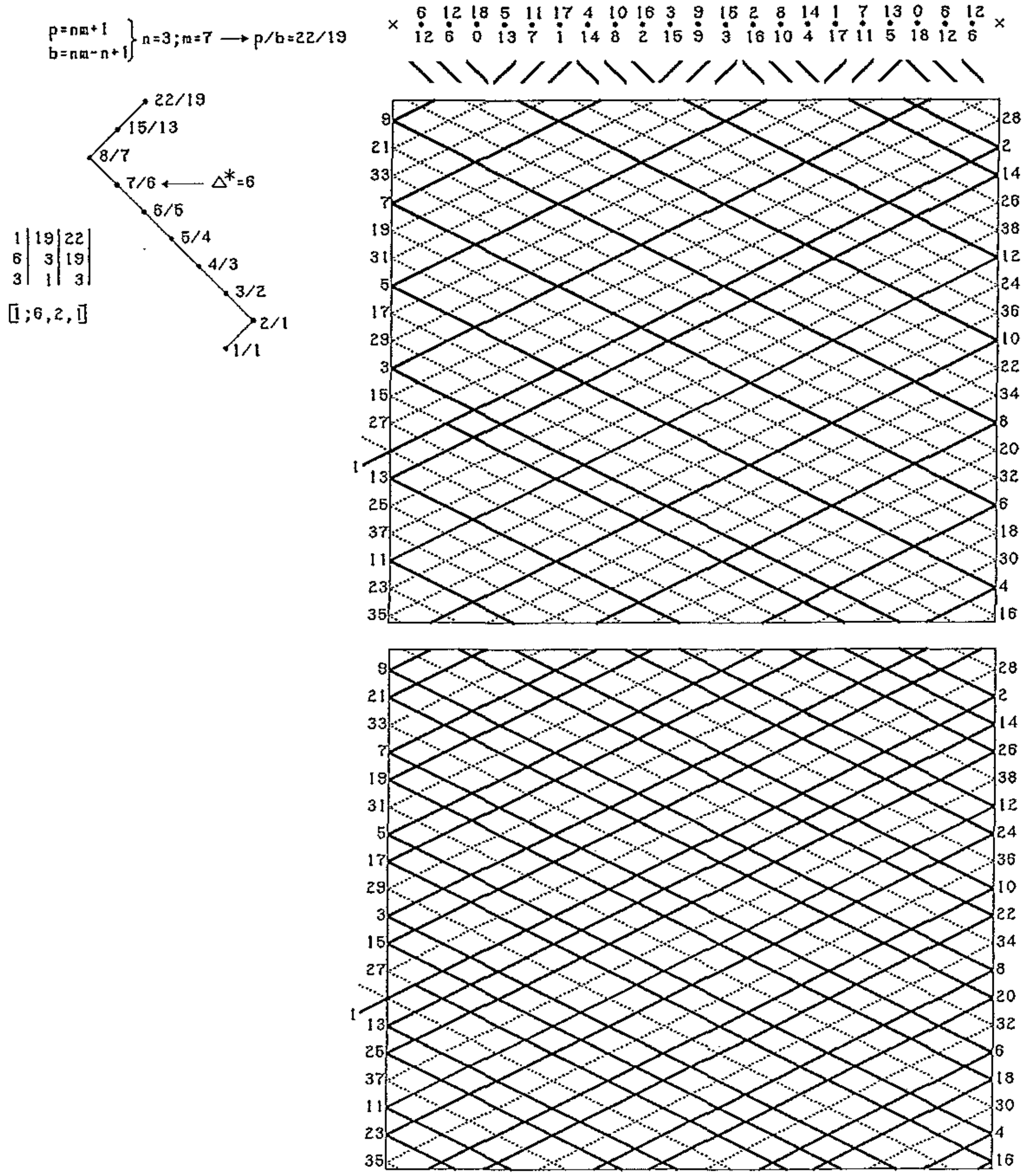


Fig. 1108 — $p = nm + 1$, $b = nm - n + 1$, where $n = 3$, $m = 7$.

set iv :

The path-formula $[0; 1, m, n-1, 1]$ of the path to $p/b = nm + 1/nm + n + 1$ in the RKT is obtained with Euclid's algorithm and from this path in the RKT we obtain $\Delta^* = nm - m + n$. See Fig. 1109. Hence $\Delta^* = b - 1 - m$ and consequently $|n\Delta^*|_b = |(n-1)b + 1|_b = 1$.

The general layout of the associated algorithm diagram is depicted in Fig. 1110. The intersection-columns, indicated by the dots, can be given an α-pass coding, where $\alpha = n$. Examples for $\alpha = n$ equal 1, 2, 3 and 4 are shown in Fig. 1112.

The braiding of such an α-pass column-coded Regular Knot consists of $n = \alpha$ stages:

the first stage produces a $p/b = m+1/m+2$ under-over coded Regular Knot (a one-pass Regular Knot), the second stage transforms this $p/b = m+1/m+2$ under-over coded Regular Knot into a $p/b = 2m+1/2m+3$ two-pass Regular Knot, the third stage transforms this $p/b = 2m+1/2m+3$ two-pass Regular Knot into a $p/b = 3m+1/3m+4$ three-pass Regular Knot, the fourth stage transforms this $p/b = 3m+1/3m+4$ three-pass Regular Knot into a $p/b = 4m+1/4m+5$ four-pass Regular Knot, and so on.

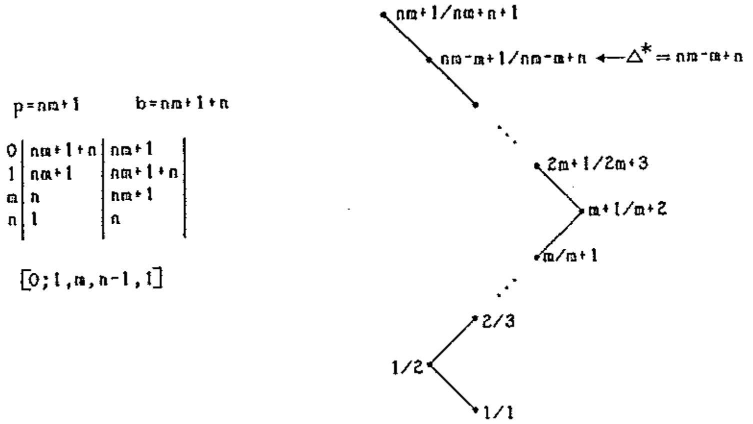


Fig. 1109 — $p = nm+1$, $b = nm+n+1$, hence $\Delta^* = nm - m + n$.

Note that the first stage is **set ii** with $n = 1$ and $nb = b = am + 2 = m + 2$. See the upper two algorithm diagrams in Fig. 1112.

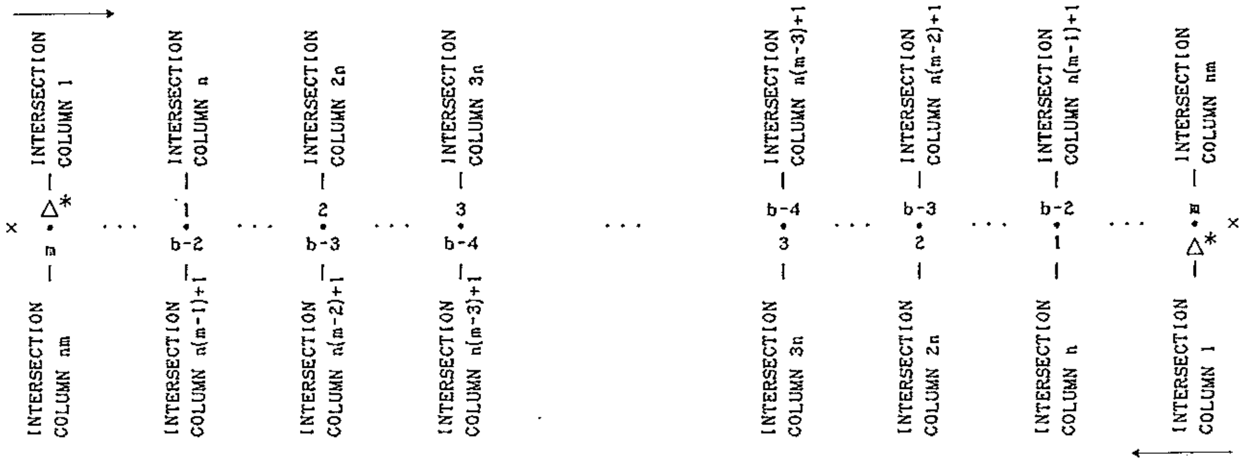


Fig. 1110 — The general layout of the algorithm diagram.

The first stage has been completed after half-cycle $2m+4$ (hence $i \leq m+1$) has been laid down up to the Standing End (half-cycle $2m+4$ reaches the Standing End after the lower left-hand m-crossing in the algorithm diagrams of Fig. 1111).

The crossings sequence associated with the first half-cycle in the second stage (half-cycle $2m+5$, hence $i \leq m+1$) is $\frac{m-1}{2} \times [u-o]-u$ when $m = odd$ or $\frac{m}{2} \times [o-u]$ when $m = even$. The crossings sequence associated with the third half-cycle in the second stage (half-cycle $2m+7$, hence $i \leq m+2$) is $2u - \frac{m-1}{2} \times [o-u]$ when $m = odd$ or $2o - \frac{m-2}{2} \times [u-o] - u$ when $m = even$.

Note that $|(n-1)\Delta^*|_b = |(n-2)b + m + 2|_b = m + 2$.

The crossings sequence associated with the fifth half-cycle in the second stage (half-cycle $2m+9$, hence $i \leq m+3$) is $2u - 2o - \frac{m-3}{2} \times [u-o] - u$ when $m = odd$ or $2o - 2u - \frac{m-2}{2} \times [o-u]$ when $m = even$. And so on.

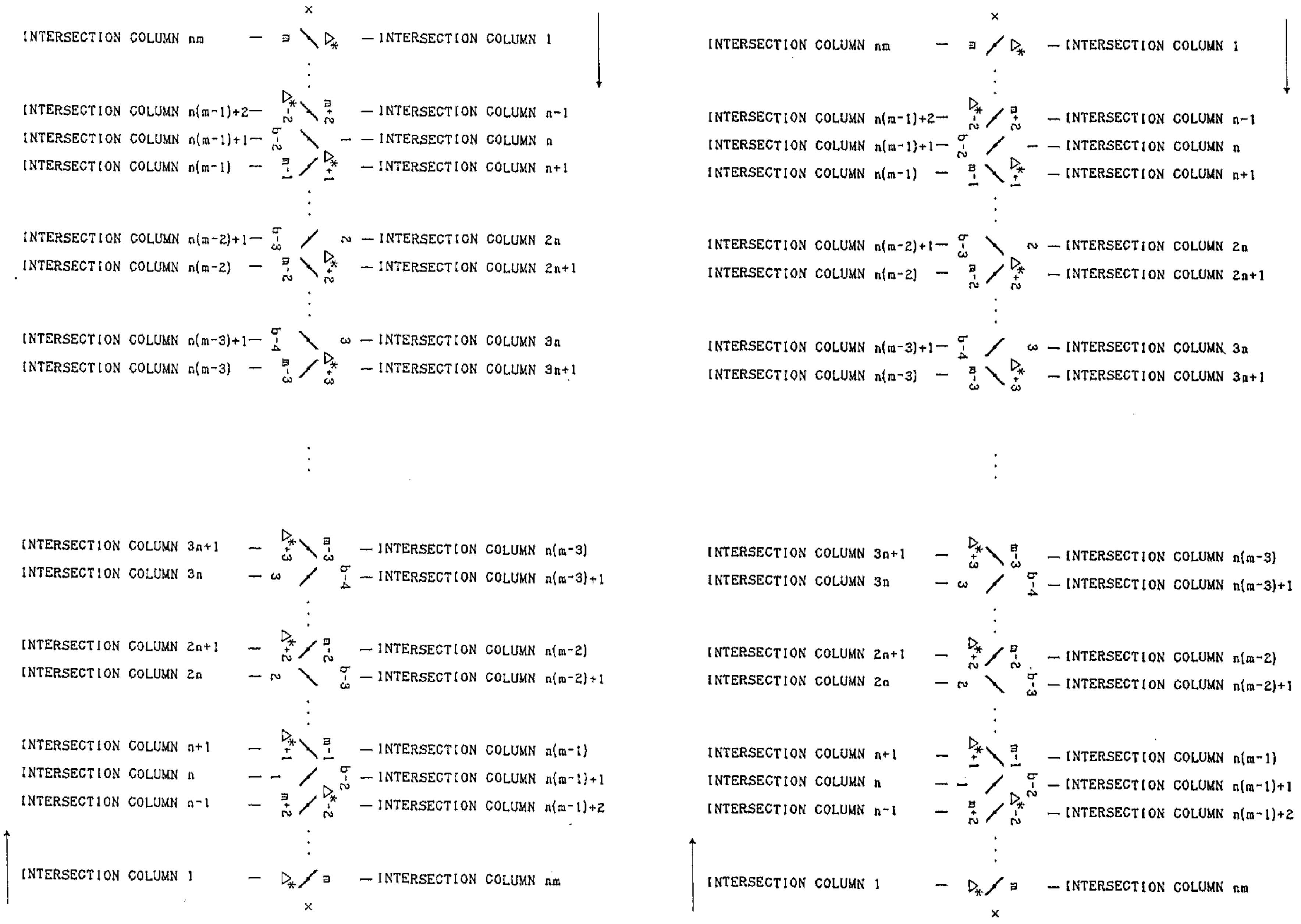


Fig. 1111 — Towards the end of the first stage, start of the second stage.

The crossings sequence associated with the second half-cycle in the second stage (half-cycle $2m+6$, hence $i \le m+2$) is $2o - \frac{m-1}{2} \times [u-o]$ when $m = odd$ or $2o - \frac{m-2}{2} \times [u-o] - u$ when $m = even$. The crossings sequence associated with the fourth half-cycle in the second stage (half-cycle $2m+8$, hence $i \le m+3$) is $2o - 2u - \frac{m-3}{2} \times [o-u] - o$ when $m = odd$ or $2o - 2u - \frac{m-2}{2} \times [o-u]$ when $m = even$. The crossings sequence associated with the sixth half-cycle in the second stage (half-cycle $2m+10$, hence $i \le m+4$) is $2o - 2u - 2o - \frac{m-3}{2} \times [u-o]$ when $m = odd$ or $2o - 2u - 2o - \frac{m-4}{2} \times [u-o] - u$ when $m = even$. And so on.

The second stage has been completed after half-cycle $4m+6$ (hence $i \le 2m+2$) has been laid down up to the Standing End (half-cycle $4m+6$ reaches the Standing End after the lower left-hand m-crossing in the algorithm diagrams of Fig. 1111).

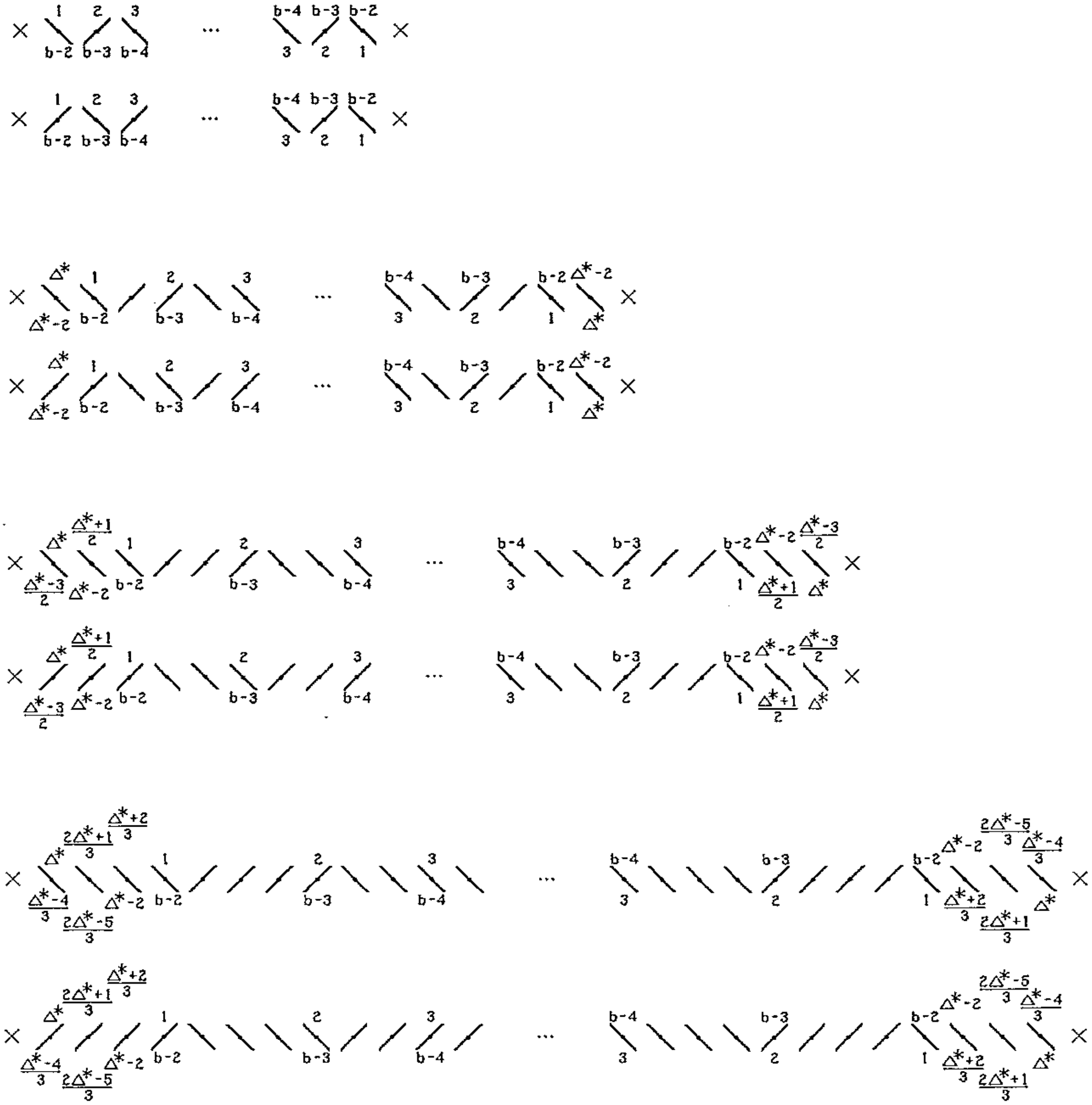


Fig. 1112 — **set iv** with $\alpha = 1, 2, 3$ and 4.

The crossings sequence associated with the first half-cycle in the third stage (half-cycle $4m+7$, hence $i \le 2m+2$) is $\frac{m-1}{2} \times [2u - 2o] - 2u$ when $m = odd$ or $\frac{m}{2} \times [2o - 2u]$ when $m = even$. The crossings sequence associated with the third half-cycle in the third stage (half-cycle $4m+9$, hence $i \leq 2m+3$) is $3u - \frac{m-1}{2} \times [2o - 2u]$ when $m = odd$ or $3o - \frac{m-2}{2} \times [2u - 2o] - 2u$ when $m = even$.

Note that $|(n-2)\Delta^*|_b = |(n-3)b + 2m + 3|_b = 2m + 3$.

The crossings sequence associated with the fifth half-cycle in the third stage (half-cycle $4m+11$, hence $i \leq 2m+4$) is $3u - 3o - \frac{m-3}{2} \times [2u - 2o] - 2u$ when $m = odd$ or $3o - 3u - \frac{m-2}{2} \times [2o - 2u]$ when $m = even$. And so on.

The crossings sequence associated with the second half-cycle in the third stage (half-cycle $4m+8$, hence $i \leq 2m+3$) is $3o - \frac{m-1}{2} \times [2u - 2o]$ when $m = odd$ or $3o - \frac{m-2}{2} \times [2u - 2o] - 2u$ when $m = even$. The crossings sequence associated with the fourth half-cycle in the third stage (half-cycle $4m+10$, hence $i \leq 2m+4$) is $3o - 3u - \frac{m-3}{2} \times [2o - 2u] - 2o$ when $m = odd$ or $3o - 3u - \frac{m-2}{2} \times [2o - 2u]$ when $m = even$. The crossings sequence associated with the sixth half-cycle in the third stage (half-cycle $4m+12$, hence $i \leq 2m+5$) is $3o - 3u - 3o - \frac{m-3}{2} \times [2u - 2o]$ when $m = odd$ or $3o - 3u - 3o - \frac{m-4}{2} \times [2u - 2o] - 2u$ when $m = even$. And so on.

The third stage has been completed after half-cycle $6m+8$ (hence $i \leq 3m+3$) has been laid down up to the Standing End (half-cycle $6m+8$ reaches the Standing End after the lower left-hand m-crossing in the algorithm diagrams of Fig. 1111).

And so on.

An example where $n = 3$, $m = 5$ is shown in Fig. 1113.

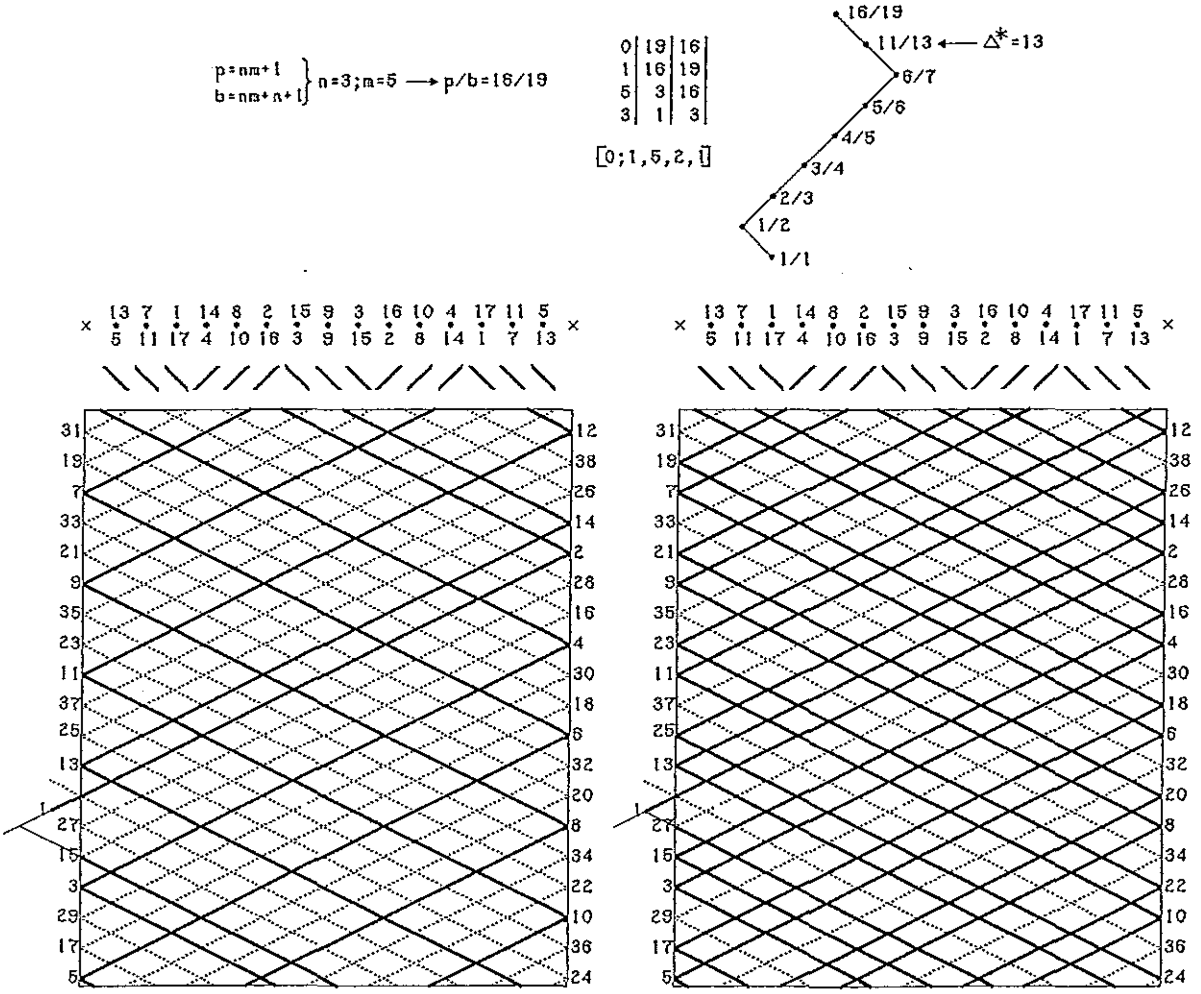


Fig. 1113 — $p = nm + 1$, $b = nm + n + 1$, where $n = 3$, $m = 5$.

The bold half-cycles in the left-hand string-run diagram are the half-cycles in the first stage. The bold half-cycles in the right-hand string-run diagram are the half-cycles in the first and second stage. The dotted half-cycles in the right-hand string-run diagram are the further half-cycles in the third stage.

Irrespective of the weaving-pattern, the braiding to a weaving-pattern is very simple for the two cases **i** and **ii** when $n = 1$, hence when $p = b+1$ and $p = b-1$ respectively since the weaving-pattern gets built up from the two bight-boundaries towards the centre. Braiding to the weaving-pattern for the two cases **iii** and **iv** is in general not quite so easy and it is in general more convenient to call in the assistance of the algorithm diagram.

Say that we like to braid the knot $p/b = nm + 1/nm + 1 - n$ (case **iii**) with the general column-coding as depicted in Fig. 1114.

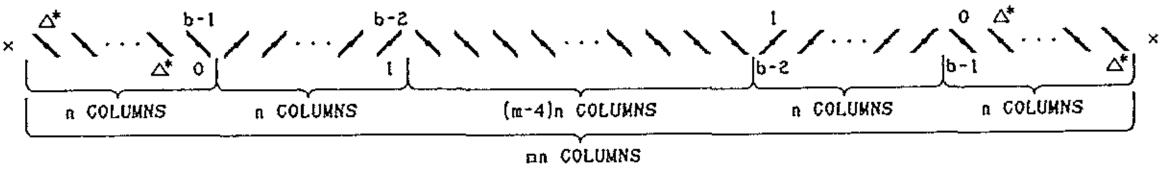


Fig. 1114 — A general column-coding.

The associated algorithm diagrams for three examples are given in Fig. 1115 (with the first crossing encountered an over-crossing).

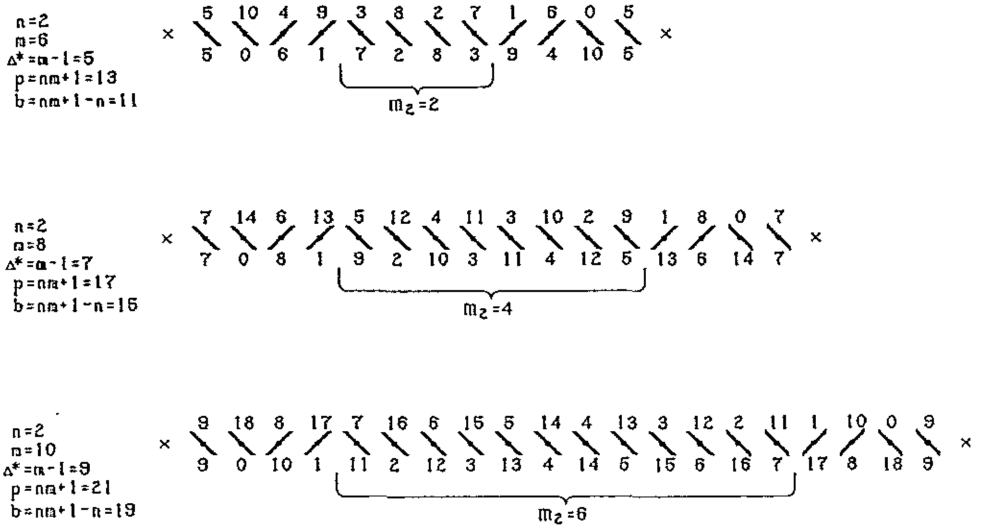


Fig. 1115 — Three examples associated with the general column-coding of Fig. 1114.

The half-cycle braiding algorithms for the second example in Fig. 1115 are:

1. : Free run.
2. $(i = 0)$: $(s)o$.
3. $(i = 0)$: u.
4. $(i \leq 1)$: $(s)u - o$.
5. $(i \leq 1)$: $o - u$.
6. $(i \leq 2)$: $(s)o - u - o$.
7. $(i \leq 2)$: $u - o - u$.
8. $(i \leq 3)$: $(s,1)2o - u - o$.
9. $(i \leq 3)$: $2u - o - u$.
10. $(i \leq 4)$: $(s,2)3o - u - o$.

11. $(i \leq 4)$: $3u - o - u$.
12. $(i \leq 5)$: $(s,3)4o - u - o$.
13. $(i \leq 5)$: $4u - o - u$.
14. $(i \leq 6)$: $(s)u - 4o - u - o$.
15. $(i \leq 6)$: $o - 4u - o - u$.
16. $(i \leq 7)$: $(s)o - u - 4o - u - (1,s)2o$.
17. $(i \leq 7)$: $u - o - 4u - o - 2u$.
18. $(i \leq 8)$: $o - u - 4o - (1,s)2u - 2o$.
19. $(i \leq 8)$: $u - o - 4u - 2o - 2u$.
20. $(i \leq 9)$: $o - u - (4,s)5o - 2u - 2o$.
21. $(i \leq 9)$: $u - o - 5u - 2o - 2u$.
22. $(i \leq 10)$: $o - u - (3,s,2)6o - 2u - 2o$.
23. $(i \leq 10)$: $u - o - 6u - 2o - 2u$.
24. $(i \leq 11)$: $o - u - (2,s,4)7o - 2u - 2o$.
25. $(i \leq 11)$: $u - o - 7u - 2o - 2u$.
26. $(i \leq 12)$: $o - u - (1,s,6)8o - 2u - 2o$.
27. $(i \leq 12)$: $u - o - 8u - 2o - 2u$.
28. $(i \leq 13)$: $o - (1,s)2u - 8o - 2u - 2o$.
29. $(i \leq 13)$: $u - 2o - 8u - 2o - 2u$.
30. $(i \leq 14)$: $(1,s)2o - 2u - 8o - 2u - 2o$.

When $m = even$, the same general arrangement of the column-coding can be obtained by doubling the n-value and halving the m-value. The resulting general column-coding is shown in Fig. 1116 (with the first crossing encountered an over-crossing).

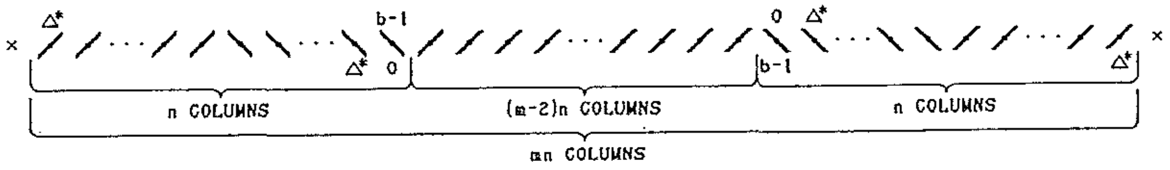


Fig. 1116 — A general column-coding.

The three examples in Fig. 1115 have then their n, m and b-values changed to those in Fig. 1117. Their p-values do of course not change.

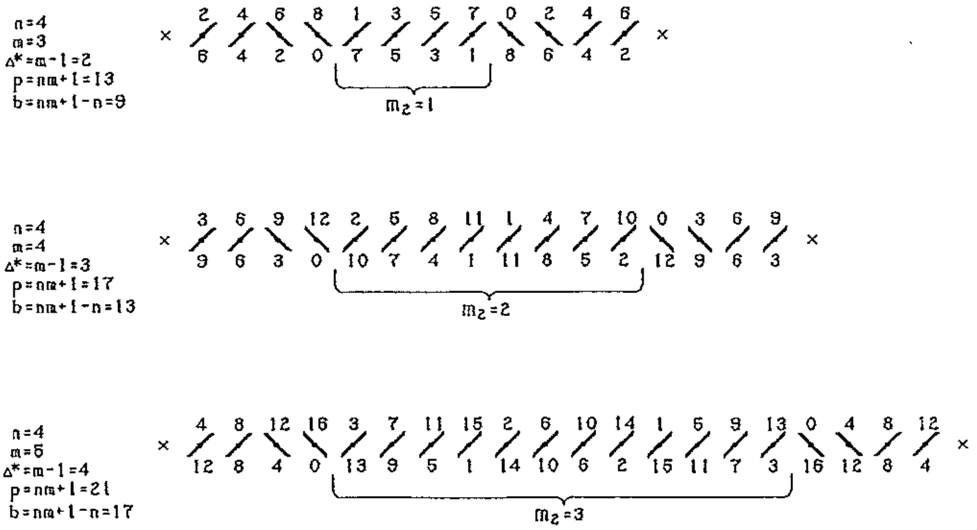


Fig. 1117 — Three examples associated with the general column-coding of Fig. 1116.

The half-cycle braiding algorithms for the second example in Fig. 1117 are:

1. : Free run.
2. $(i = 0)$: $(s)o$.
3. $(i = 0)$: u.
4. $(i \leq 1)$: $(s)u - o$.
5. $(i \leq 1)$: $o - u$.
6. $(i \leq 2)$: $(s, 1)2u - o$.
7. $(i \leq 2)$: $2o - u$.
8. $(i \leq 3)$: $(s, 2)3u - (1, s)2o$.
9. $(i \leq 3)$: $3o - 2u$.
10. $(i \leq 4)$: $(3, s)4u - 2o$.
11. $(i \leq 4)$: $4o - 2u$.
12. $(i \leq 5)$: $(2, s, 2)5u - 2o$.
13. $(i \leq 5)$: $5o - 2u$.
14. $(i \leq 6)$: $(1, s, 4)6u - 2o - (s)u$.
15. $(i \leq 6)$: $6o - 2u - o$.
16. $(i \leq 7)$: $(6, s)7u - 2o - u$.
17. $(i \leq 7)$: $7o - 2u - o$.
18. $(i \leq 8)$: $(4, s, 3)8u - 2o - u$.
19. $(i \leq 8)$: $8o - 2u - o$.
20. $(i \leq 9)$: $2u - (s)o - 6u - 2o - (1, s)2u$.
21. $(i \leq 9)$: $2o - u - 6o - 2u - 2o$.
22. $(i \leq 10)$: $2u - o - (6, s)7u - 2o - 2u$.
23. $(i \leq 10)$: $2o - u - 7o - 2u - 2o$.
24. $(i \leq 11)$: $2u - o - (3, s, 4)8u - 2o - 2u$.
25. $(i \leq 11)$: $2o - u - 8o - 2u - 2o$.
26. $(i \leq 12)$: $2u - (1, s)2o - 8u - 2o - 2u$.

Say that we like to braid the knot $p/b = nm + 1/nm + 1 + n$ (case **iv**) with the general column-coding as depicted in Fig. 1118.

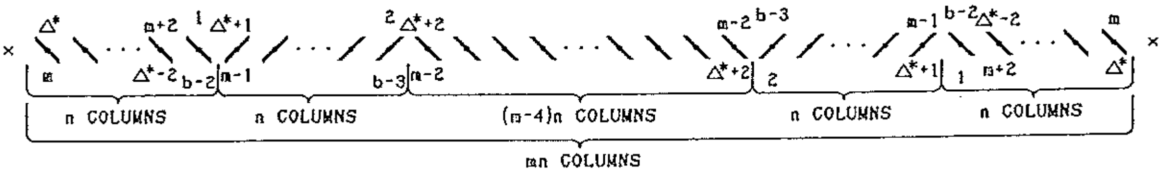


Fig. 1118 — A general column-coding.

The associated algorithm diagrams for three examples are given in Fig. 1119 (with the first crossing encountered an over-crossing). The half-cycle braiding algorithms for the second example in Fig. 1119 are:

1. : Free run.
2. $(i = 0)$: Free run.
3. $(i = 0)$: Free run.
4. $(i \leq 1)$: $(s)o$.
5. $(i \leq 1)$: u.
6. $(i \leq 2)$: $o - (s)u$.
7. $(i \leq 2)$: $u - o$.
8. $(i \leq 3)$: $o - u - (s)o$.
9. $(i \leq 3)$: $u - o - u$.

10. $(i \leq 4)$: $o - u - (1,s)2o$.
11. $(i \leq 4)$: $u - o - 2u$.
12. $(i \leq 5)$: $o - u - (2,s)3o$.
13. $(i \leq 5)$: $u - o - 3u$.
14. $(i \leq 6)$: $o - u - (3,s)4o$.
15. $(i \leq 6)$: $u - o - 4u$.
16. $(i \leq 7)$: $o - u - 4o - (s)u$.
17. $(i \leq 7)$: $u - o - 4u - o$.
18. $(i \leq 8)$: $o - u - 4o - u - (s)o$.
19. $(i \leq 8)$: $u - o - 4u - o - u$.
20. $(i \leq 9)$: $o - u - 4o - u - o$.
21. $(i \leq 9)$: $u - o - 4u - o - u$.
22. $(i \leq 10)$: $(s,1)2o - u - 4o - u - o$.
23. $(i \leq 10)$: $2u - o - 4u - o - u$.
24. $(i \leq 11)$: $2o - (s,1)2u - 4o - u - o$.
25. $(i \leq 11)$: $2u - 2o - 4u - o - u$.
26. $(i \leq 12)$: $2o - 2u - (s,4)5o - u - o$.
27. $(i \leq 12)$: $2u - 2o - 5u - o - u$.
28. $(i \leq 13)$: $2o - 2u - (2,s,3)6o - u - o$.
29. $(i \leq 13)$: $2u - 2o - 6u - o - u$.
30. $(i \leq 14)$: $2o - 2u - (4,s,2)7o - u - o$.
31. $(i \leq 14)$: $2u - 2o - 7u - o - u$.
32. $(i \leq 15)$: $2o - 2u - (6,s,1)8o - u - o$.
33. $(i \leq 15)$: $2u - 2o - 8u - o - u$.
34. $(i \leq 16)$: $2o - 2u - 8o - (s,1)2u - o$.
35. $(i \leq 16)$: $2u - 2o - 8u - 2o - u$.
36. $(i \leq 17)$: $2o - 2u - 8o - 2u - (s,1)2o$.
37. $(i \leq 17)$: $2u - 2o - 8u - 2o - 2u$.
38. $(i \leq 18)$: $2o - 2u - 8o - 2u - 2o$.

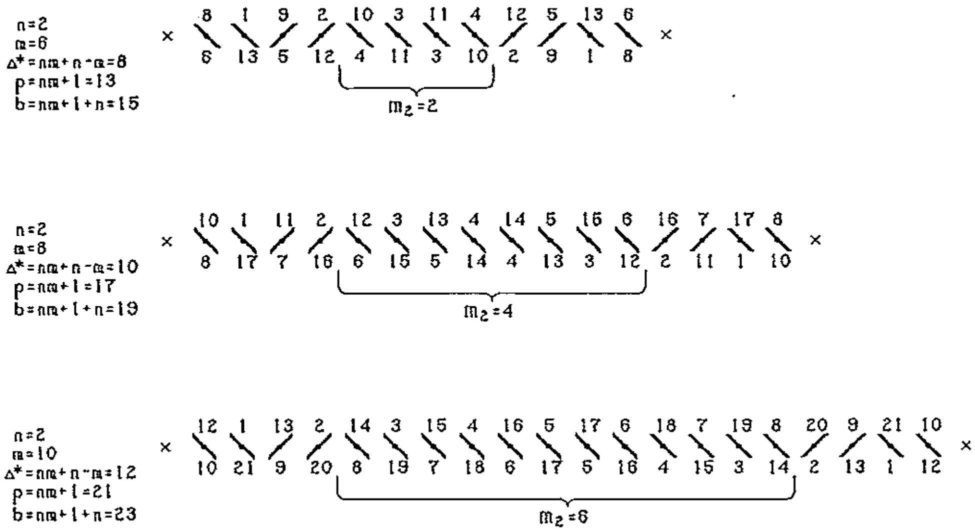


Fig. 1119 — Three examples associated with the general column-coding of Fig. 1118.

When $m = even$, the same general arrangement of the column-coding can be obtained by doubling the n-value and halving the m-value. The resulting general column-coding is shown in Fig. 1120 (with the first crossing encountered an over-crossing). The three examples in Fig. 1119 have then their n, m and b-values changed to those in Fig. 1121. Their p-values do of course not change.

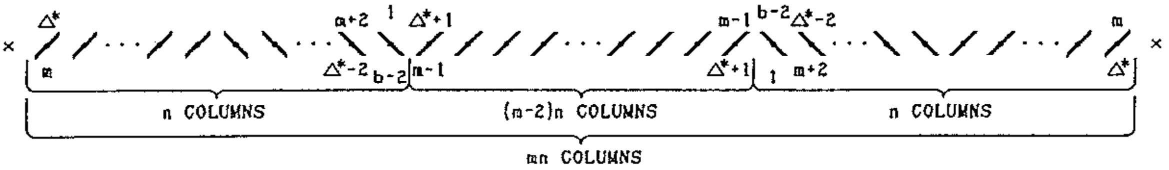


Fig. 1120 — A general column-coding.

The half-cycle braiding algorithms for the second example in Fig. 1121 are:

1. : Free run.
2. $(i = 0)$: Free run.
3. $(i = 0)$: Free run.
4. $(i \leq 1)$: $(s)o$.
5. $(i \leq 1)$: u.
6. $(i \leq 2)$: $o - (s)u$.
7. $(i \leq 2)$: $u - o$.
8. $(i \leq 3)$: $o - (1, s)2u$.
9. $(i \leq 3)$: $u - 2o$.
10. $(i \leq 4)$: $o - (2, s)3u$.
11. $(i \leq 4)$: $u - 3o$.
12. $(i \leq 5)$: $o - 3u$.
13. $(i \leq 5)$: $u - 3o$.
14. $(i \leq 6)$: $(s, 1)2o - 3u$.
15. $(i \leq 6)$: $2u - 3o$.
16. $(i \leq 7)$: $2o - (s, 3)4u$.
17. $(i \leq 7)$: $2u - 4o$.
18. $(i \leq 8)$: $2o - (2, s, 2)5u$.
19. $(i \leq 8)$: $2u - 5o$.
20. $(i \leq 9)$: $2o - (4, s, 1)6u$.
21. $(i \leq 9)$: $2u - 6o$.
22. $(i \leq 10)$: $2o - 6u$.
23. $(i \leq 10)$: $2u - 6o$.
24. $(i \leq 11)$: $(s)u - 2o - 6u$.
25. $(i \leq 11)$: $o - 2u - 6o$.
26. $(i \leq 12)$: $u - 2o - (s, 6)7u$.
27. $(i \leq 12)$: $o - 2u - 7o$.
28. $(i \leq 13)$: $u - 2o - (3, s, 4)8u$.
29. $(i \leq 13)$: $o - 2u - 8o$.
30. $(i \leq 14)$: $u - 2o - 6u - (s)o - 2u$.
31. $(i \leq 14)$: $o - 2u - 6o - u - 2o$.
32. $(i \leq 15)$: $u - 2o - 6u - o - 2u$.
33. $(i \leq 15)$: $o - 2u - 6o - u - 2o$.
34. $(i \leq 16)$: $(s, 1)2u - 2o - 6u - o - 2u$.
35. $(i \leq 16)$: $2o - 2u - 6o - u - 2o$.
36. $(i \leq 17)$: $2u - 2o - (s, 6)7u - o - 2u$.
37. $(i \leq 17)$: $2o - 2u - 7o - u - 2o$.
38. $(i \leq 18)$: $2u - 2o - (4, s, 3)8u - o - 2u$.

39. $(i \leq 18)$: $2o - 2u - 8o - u - 2o$.
40. $(i \leq 19)$: $2u - 2o - 8u - (s,1)2o - 2u$.
41. $(i \leq 19)$: $2o - 2u - 8o - 2u - 2o$.
42. $(i \leq 20)$: $2u - 2o - 8u - 2o - 2u$.

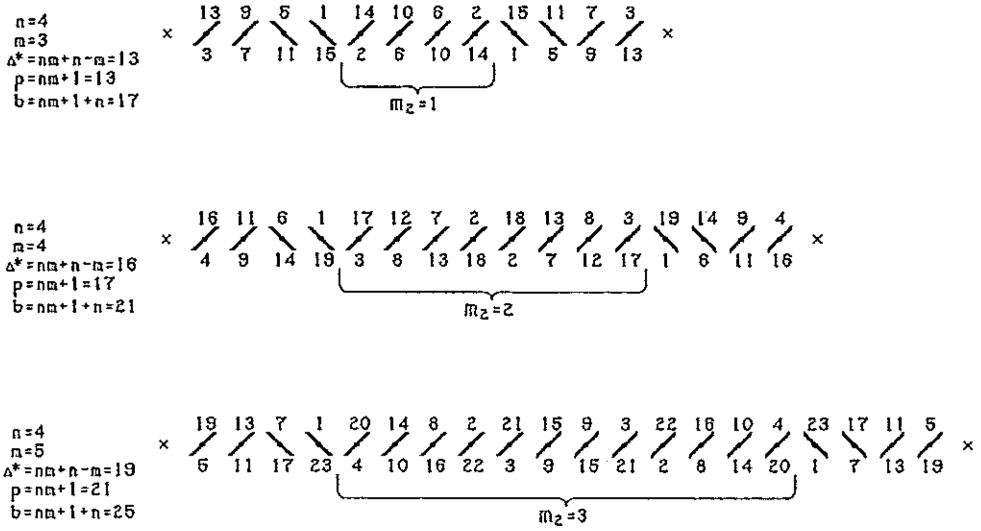


Fig. 1121 — Three examples associated with the general column-coding of Fig. 1120.

When the length of the string required is long, we would of course start braiding from the centre of the string-length. We would thus, for example, braid the second example in Fig. 1121 as follows:

Braid the first twenty two (22) half-cycles as indicated above. Then starting with the Standing End, braid the next twenty (20) half-cycles as follows:

23. $(i \leq 10)$: $2o - 6u$.
24. $(i \leq 11)$: $(s)o - 2u - 6o$.
25. $(i \leq 11)$: $u - 2o - 6u$.
26. $(i \leq 12)$: $o - 2u - (s,6)7o$.
27. $(i \leq 12)$: $u - 2o - 7u$.
28. $(i \leq 13)$: $o - 2u - (3,s,4)8o$.
29. $(i \leq 13)$: $u - 2o - 8u$.
30. $(i \leq 14)$: $o - 2u - 6o - (s)u - 2o$.
31. $(i \leq 14)$: $u - 2o - 6u - o - 2u$.
32. $(i \leq 15)$: $o - 2u - 6o - u - 2o$.
33. $(i \leq 15)$: $u - 2o - 6u - o - 2u$.
34. $(i \leq 16)$: $(s,1)2o - 2u - 6o - u - 2o$.
35. $(i \leq 16)$: $2u - 2o - 6u - o - 2u$.
36. $(i \leq 17)$: $2o - 2u - (s,6)7o - u - 2o$.
37. $(i \leq 17)$: $2u - 2o - 7u - o - 2u$.
38. $(i \leq 18)$: $2o - 2u - (4,s,3)8o - u - 2o$.
39. $(i \leq 18)$: $2u - 2o - 8u - o - 2u$.
40. $(i \leq 19)$: $2o - 2u - 8o - (s,1)2u - 2o$.
41. $(i \leq 19)$: $2u - 2o - 8u - 2o - 2u$.
42. $(i \leq 20)$: $2o - 2u - 8o - 2u - 2o$.

Note that the Standing End for these twenty half-cycles is the end of half-cycle 22.

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A quarterly publication
for
the braiding artisan

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A Braiding Project — A walking stick with knots

We shall continue our walking stick project in Issue No. 57 with some knot examples.

With braided synthetic round cord as the braiding material, the minimum helix angle for an acceptable appearance of the braid is about 45°. Hence for braided synthetic round cord with a diameter d of 2 mm., the maximum number of bights b around a diameter D of 25 mm. is about $\dfrac{\pi \times (D+2d) \times \cos 45°}{d} = \dfrac{\pi \times (25+4) \times \cos 45°}{2} = 32$, while the maximum number of bights b around a diameter D of 19 mm. is about $\dfrac{\pi \times (D+2d) \times \cos 45°}{d} = \dfrac{\pi \times (19+4) \times \cos 45°}{2} = 25$. These maximum bight numbers should be taken into account when a section of a knot gets interbraided so that this section contains a greater number of bights than other sections of the knot.

With braided synthetic round cord as the braiding material, the maximum helix angle for an acceptable appearance of the braid should in general not exceed 75°. For braided synthetic round cord of $d = 2$ mm. diameter, the minimum number of bights b around a diameter D of 25 mm. is about $\dfrac{\pi \times (D+2d) \times \cos 75°}{d} = \dfrac{\pi \times (25+4) \times \cos 75°}{2} = 12$, while the minimum number of bights b around a diameter D of 19 mm. is about $\dfrac{\pi \times (D+2d) \times \cos 75°}{d} = \dfrac{\pi \times (19+4) \times \cos 75°}{2} = 9$.

For a good appearance of the braided knot it is very important that the visible parts of the string(s) lie tight against each other and that the intersection-columns are parallel to the centre-line, hence do not describe a helix.

Knot 1.

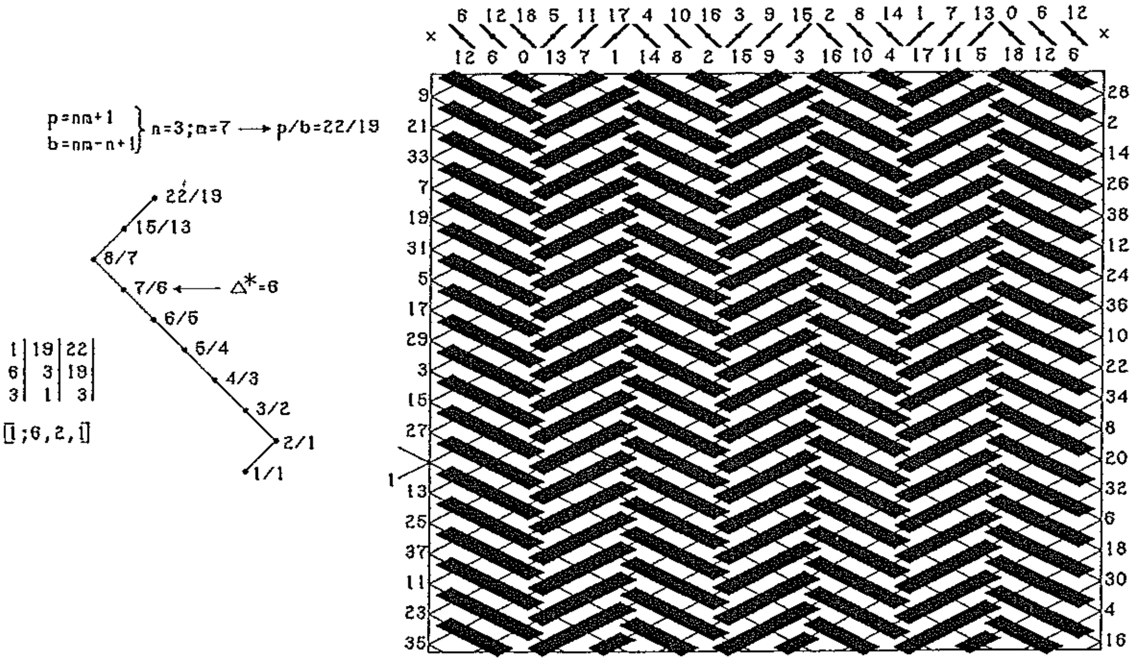

Fig. 1122 — Knot 1.

This is the knot discussed in *The Braider*, Issue No. 57, pp. 1365–1366; it belongs to the set iii of knots discussed in that Issue on pp. 1357–1366. It can readily be braided to its weaving-pattern. However, for those who prefer to braid knots to their half-cycle braiding algorithms, its half-cycle braiding algorithms for braiding it by starting from the centre of the string-length are as follows (associated grid-diagram is depicted in Fig. 1123):

1. : Free run.
2. $(i = 0)$: $(s)o$.
3. $(i = 0)$: u.
4. $(i \leq 1)$: $(s)u - o$.
5. $(i \leq 1)$: $o - u$.
6. $(i \leq 2)$: $(s)o - u - o$.
7. $(i \leq 2)$: $u - o - u$.
8. $(i \leq 3)$: $(s)u - o - u - o$.
9. $(i \leq 3)$: $o - u - o - u$.
10. $(i \leq 4)$: $(s)o - u - o - u - o$.
11. $(i \leq 4)$: $u - o - u - o - u$.
12. $(i \leq 5)$: $(s)u - o - u - o - u - o$.
13. $(i \leq 5)$: $o - u - o - u - o - u$.
14. $(i \leq 6)$: $(s)o - u - o - u - o - u - (1,s)2o$.
15. $(i \leq 6)$: $u - o - u - o - u - o - 2u$.
16. $(i \leq 7)$: $o - u - o - u - o - (1,s)2u - 2o$.
17. $(i \leq 7)$: $u - o - u - o - u - 2o - 2u$.
18. $(i \leq 8)$: $o - u - o - u - (1,s)2o - 2u - 2o$.

The end of half-cycle 18 is the Standing End associated with the half-cycles 19–38.

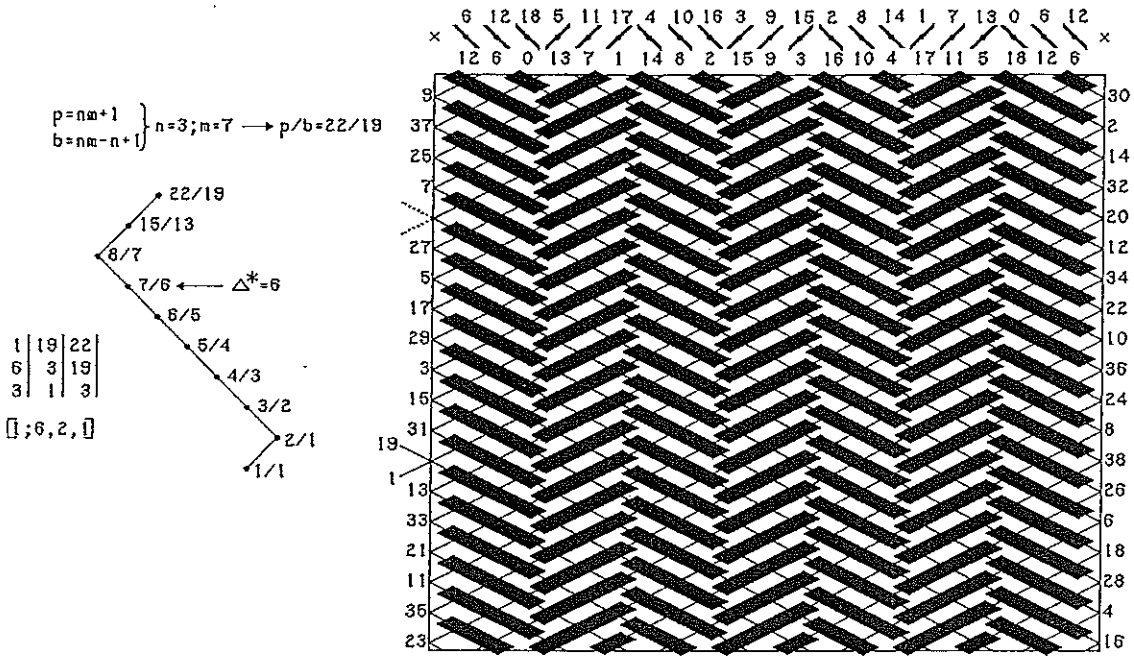

Fig. 1123 — Knot 1. Braiding process starting at centre of string-length.

19. $(i \leq 8)$: $o - u - o - u - 2o - 2u - 2o$.
20. $(i \leq 9)$: $u - o - u - (1,s)2o - 2u - 2o - 2u$.
21. $(i \leq 9)$: $o - u - o - 2u - 2o - 2u - 2o$.
22. $(i \leq 10)$: $u - o - (1,s)2u - 2o - 2u - 2o - 2u$.
23. $(i \leq 10)$: $o - u - 2o - 2u - 2o - 2u - 2o$.
24. $(i \leq 11)$: $u - (1,s)2o - 2u - 2o - 2u - 2o - 2u$.

25. $(i \leq 11)$: $o - 2u - 2o - 2u - 2o - 2u - 2o$.
26. $(i \leq 12)$: $(1,s)2u - 2o - 2u - 2o - 2u - 2o - (2,s)3u$.
27. $(i \leq 12)$: $2o - 2u - 2o - 2u - 2o - 2u - 3o$.
28. $(i \leq 13)$: $2u - 2o - 2u - 2o - 2u - (2,s)3o - 3u$.
29. $(i \leq 13)$: $2o - 2u - 2o - 2u - 2o - 3u - 3o$.
30. $(i \leq 14)$: $2u - 2o - 2u - 2o - (2,s)3u - 3o - 3u$.
31. $(i \leq 14)$: $2o - 2u - 2o - 2u - 3o - 3u - 3o$.
32. $(i \leq 15)$: $2u - 2o - 2u - (2,s)3o - 3u - 3o - 3u$.
33. $(i \leq 15)$: $2o - 2u - 2o - 3u - 3o - 3u - 3o$.
34. $(i \leq 16)$: $2u - 2o - (2,s)3u - 3o - 3u - 3o - 3u$.
35. $(i \leq 16)$: $2o - 2u - 3o - 3u - 3o - 3u - 3o$.
36. $(i \leq 17)$: $2u - (2,s)3o - 3u - 3o - 3u - 3o - 3u$.
37. $(i \leq 17)$: $2o - 3u - 3o - 3u - 3o - 3u - 3o$.
38. $(i \leq 18)$: $(2,s)3u - 3o - 3u - 3o - 3u - 3o - 3u$.

Knot 2.

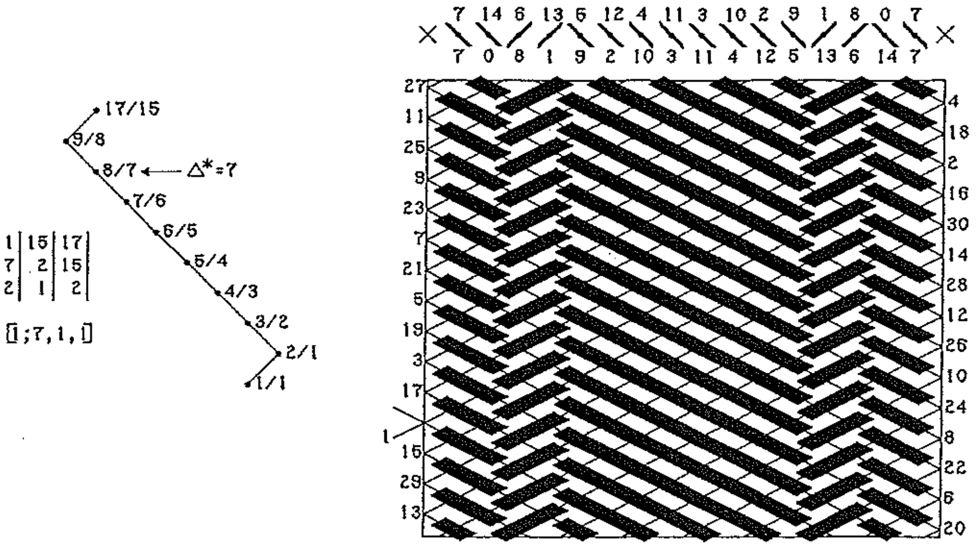

Fig. 1124 — Knot 2.

This is the second knot example in Fig. 1115 discussed in *The Braider*, Issue No. 57, pp. 1371–1372; it belongs to the set **iii** of knots discussed in that Issue on pg. 1371. It can readily be braided to its weaving-pattern. However, it might be a little more convenient to call in the assistance of its algorithm diagram and use its half-cycle braiding algorithms. Let's braid it by starting from the centre of the string-length (associated grid-diagram is then as depicted in Fig. 1125). The half-cycle braiding algorithms are as follows:

1. : Free run.
2. $(i = 0)$: $(s)o$.
3. $(i = 0)$: u.
4. $(i \leq 1)$: $(s)u - o$.
5. $(i \leq 1)$: $o - u$.
6. $(i \leq 2)$: $(s)o - u - o$.
7. $(i \leq 2)$: $u - o - u$.
8. $(i \leq 3)$: $(s,1)2o - u - o$.
9. $(i \leq 3)$: $2u - o - u$.
10. $(i \leq 4)$: $(s,2)3o - u - o$.

11. $(i \leq 4)$: $3u - o - u$.
12. $(i \leq 5)$: $(s,3)4o - u - o$.
13. $(i \leq 5)$: $4u - o - u$.
14. $(i \leq 6)$: $(s)u - 4o - u - o$.

The end of half-cycle 14 is the Standing End associated with the half-cycles 15–30.

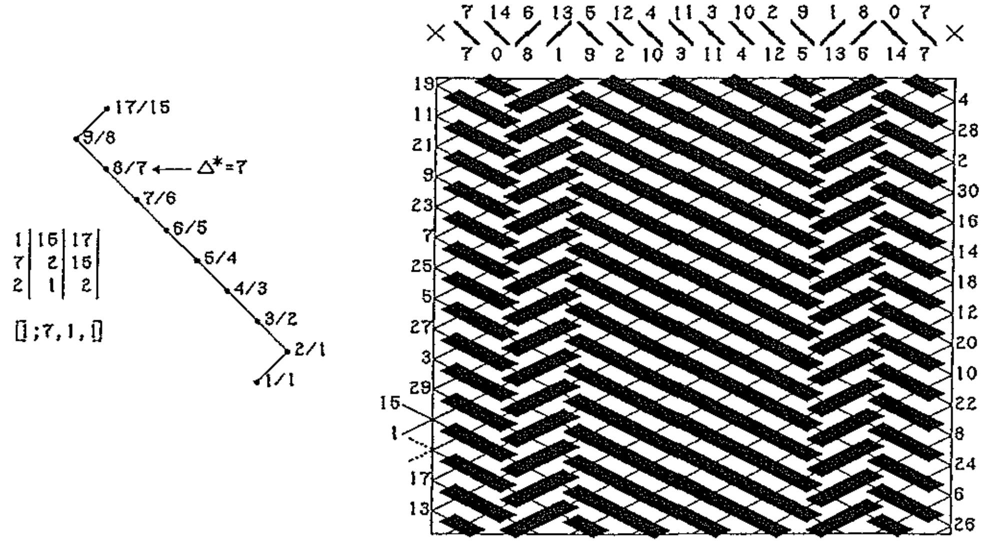

Fig. 1125 — Knot 2. Braiding process starting at centre of string-length.

15. $(i \leq 6)$: $u - 4o - u - o$.
16. $(i \leq 7)$: $(s)u - o - 4u - o - (1,s)2u$.
17. $(i \leq 7)$: $o - u - 4o - u - 2o$.
18. $(i \leq 8)$: $u - o - 4u - (1,s)2o - 2u$.
19. $(i \leq 8)$: $o - u - 4o - 2u - 2o$.
20. $(i \leq 9)$: $u - o - (4,s)5u - 2o - 2u$.
21. $(i \leq 9)$: $o - u - 5o - 2u - 2o$.
22. $(i \leq 10)$: $u - o - (3,s,2)6u - 2o - 2u$.
23. $(i \leq 10)$: $o - u - 6o - 2u - 2o$.
24. $(i \leq 11)$: $u - o - (2,s,4)7u - 2o - 2u$.
25. $(i \leq 11)$: $o - u - 7o - 2u - 2o$.
26. $(i \leq 12)$: $u - o - (1,s,6)8u - 2o - 2u$.
27. $(i \leq 12)$: $o - u - 8o - 2u - 2o$.
28. $(i \leq 13)$: $u - (1,s)2o - 8u - 2o - 2u$.
29. $(i \leq 13)$: $o - 2u - 8o - 2u - 2o$.
30. $(i \leq 14)$: $(1,s)2u - 2o - 8u - 2o - 2u$.

Knot 3.

This knot consists of a $p/b = 35/12$ Regular Knot as foundation knot, interbraided with a $p'/b = 7/12$ Regular Knot (see Fig. 1126). The helix angle of the string-run outside the interbraided central section is different to (greater than) the helix angle of the string-run of the interbraided central section. It is very important to ensure that the bights of the foundation knot are regularly spaced around the circumference of the stick and that the visible parts of the string(s) lie tight against each other. This last condition is being facilitated by the local 2–pass coding of the foundation knot at the transitions from its non interbraided sections to its interbraided section.

Let's braid the foundation knot by starting from the centre of its string-length.

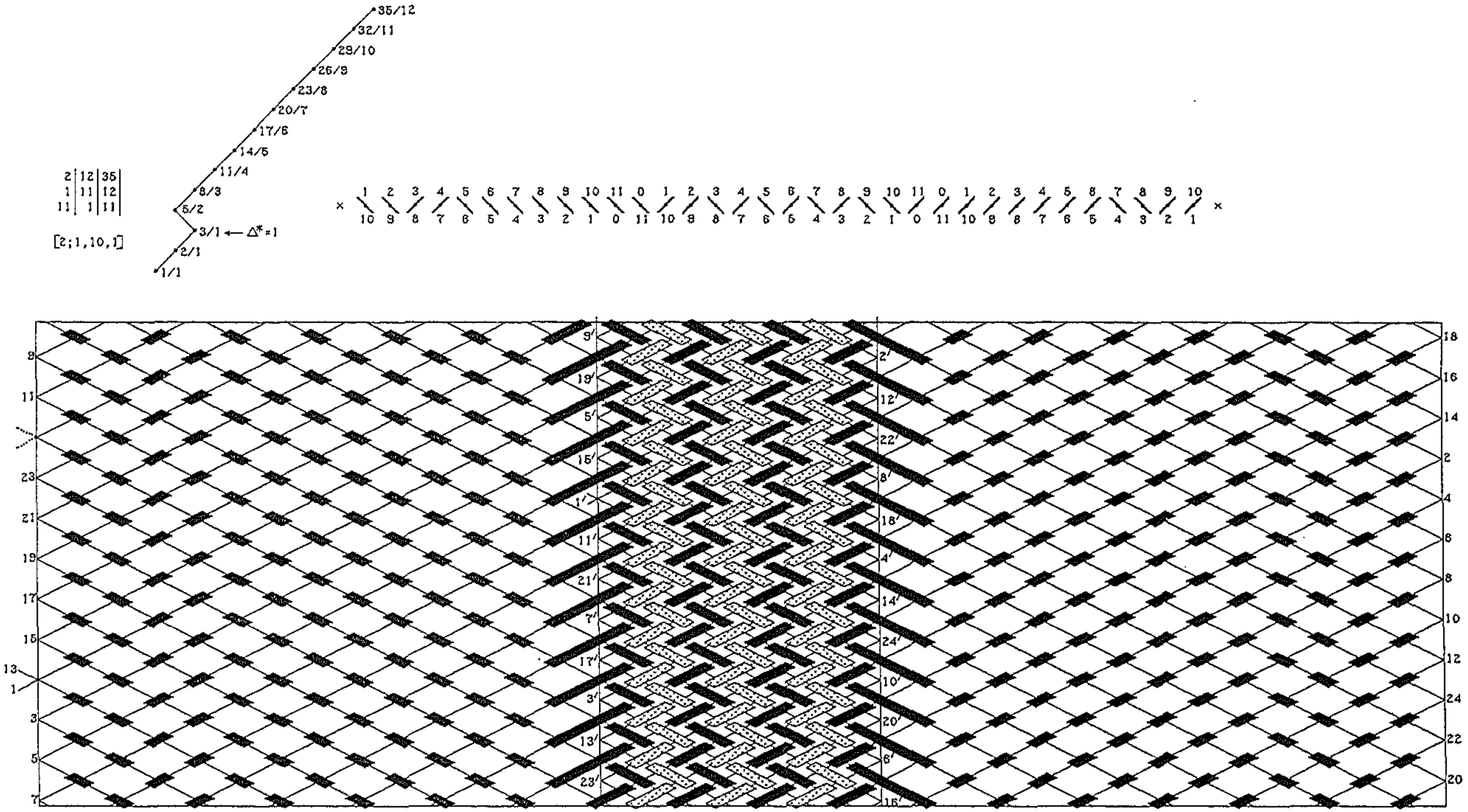

Fig. 1126 — Knot 3. Start the foundation knot at the centre of its string-length.

The half-cycle braiding algorithms for the foundation knot are as follows:

1. : Free run.
2. $(i = 0)$: $(s)u - (s)o$.
3. $(i = 0)$: $u - o$.
4. $(i \leq 1)$: $(s,1)2u - (s,1,s)3o$.
5. $(i \leq 1)$: $2u - 3o$.
6. $(i \leq 2)$: $(1,s,1)3u - (1,s,2,s)5o$.
7. $(i \leq 2)$: $3u - 5o$.
8. $(i \leq 3)$: $2u - (s)o - u - 2o - (s)u - (3,s)4o$.
9. $(i \leq 3)$: $2u - o - u - 2o - u - 4o$.
10. $(i \leq 4)$: $2u - (1,s)2o - u - 2o - u - (s,4,s)6o$.
11. $(i \leq 4)$: $2u - 2o - u - 2o - u - 6o$.
12. $(i \leq 5)$: $2u - 2o - (s,1)2u - 2o - u - o - (s)u - (5,s)6o$.

The end of half-cycle 12 is the Standing End associated with the half-cycles 13–24.

13. $(i \leq 5)$: $2o - 2u - 2o - 2u - o - u - o - 6u$.
14. $(i \leq 6)$: $2o - 2u - (1,s,1)3o - 2u - o - u - o - (s,6,s)8u$.
15. $(i \leq 6)$: $2o - 2u - 3o - 2u - o - u - o - 8u$.
16. $(i \leq 7)$: $2o - 2u - (2,s,1)4o - 2u - o - u - o - u - (s)o - 7u - (s)o$.
17. $(i \leq 7)$: $2o - 2u - 4o - 2u - o - u - o - u - o - 7u - o$.
18. $(i \leq 8)$: $2o - 2u - (3,s,1)5o - 2u - o - u - o - u - o - (s,7)8u - (1,s)2o$.
19. $(i \leq 8)$: $2o - 2u - 5o - 2u - o - u - o - u - o - 8u - 2o$.
20. $(i \leq 9)$: $2o - 2u - (4,s,1)6o - 2u - o - u - o - u - o - u - (s)o - 7u - 2o - (s)u$.
21. $(i \leq 9)$: $2o - 2u - 6o - 2u - o - u - o - u - o - u - o - 7u - 2o - u$.
22. $(i \leq 10)$: $2o - 2u - (5,s,1)7o - 2u - o - u - o - u - o - u - (1,s)2o - 7u - 2o - (1,s)2u$.
23. $(i \leq 10)$: $2o - 2u - 7o - 2u - o - u - o - u - o - u - 2o - 7u - 2o - 2u$.
24. $(i \leq 11)$: $2o - 2u - (6,s,1)8o - 2u - o - u - o - u - o - u - 2o - (s,7)8u - 2o - 2u$.

The half-cycle braiding algorithms for the $p'/b = 7/12$ interbraided Regular Knot can be read from its algorithm diagram in Fig. 1127:

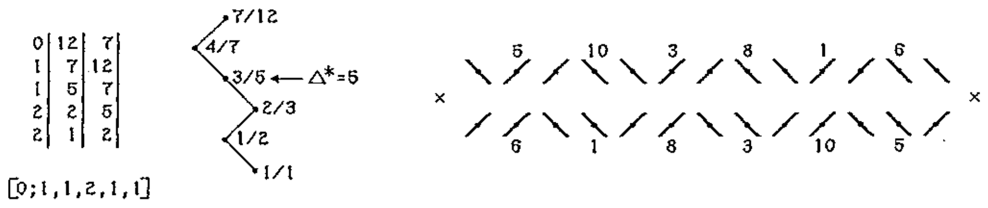

Fig. 1127 — The interbraided $p'/b = 7/12$ Regular Knot.

1′. : $u - o - u - o - u - o - u$.
2′. $(i = 0)$: $u - o - u - o - u - o - u$.
3′. $(i = 0)$: $u - o - u - o - u - o - u$.
4′. $(i \leq 1)$: $u - o - u - o - u - (s,1)2o - u$.
5′. $(i \leq 1)$: $u - o - u - o - u - 2o - u$.
6′. $(i \leq 2)$: $u - o - u - o - u - 2o - u$.
7′. $(i \leq 2)$: $u - o - u - o - u - 2o - u$.

8′. $(i \le 3)$: $u - o - u - (s,1)2o - u - 2o - u$.
9′. $(i \le 3)$: $u - o - u - 2o - u - 2o - u$.
10′. $(i \le 4)$: $u - o - u - 2o - u - 2o - u$.
11′. $(i \le 4)$: $u - o - u - 2o - u - 2o - u$.
12′. $(i \le 5)$: $u - (s,1)2o - u - 2o - u - 2o - u$.
13′. $(i \le 5)$: $u - 2o - u - 2o - u - 2o - u$.
14′. $(i \le 6)$: $u - 2o - u - 2o - u - 2o - (s,1)2u$.
15′. $(i \le 6)$: $u - 2o - u - 2o - u - 2o - 2u$.
16′. $(i \le 7)$: $u - 2o - u - 2o - u - 2o - 2u$.
17′. $(i \le 7)$: $u - 2o - u - 2o - u - 2o - 2u$.
18′. $(i \le 8)$: $u - 2o - u - 2o - (s,1)2u - 2o - 2u$.
19′. $(i \le 8)$: $u - 2o - u - 2o - 2u - 2o - 2u$.
20′. $(i \le 9)$: $u - 2o - u - 2o - 2u - 2o - 2u$.
21′. $(i \le 9)$: $u - 2o - u - 2o - 2u - 2o - 2u$.
22′. $(i \le 10)$: $u - 2o - (s,1)2u - 2o - 2u - 2o - 2u$.
23′. $(i \le 10)$: $u - 2o - 2u - 2o - 2u - 2o - 2u$.
24′. $(i \le 11)$: $u - 2o - 2u - 2o - 2u - 2o - 2u$.

Knot 4.

The foundation knot (Regular Knot with $p/b = 17/11$) is centrally interbraided with two Regular Knots, each with $p/b = 5/11$ (see Fig. 1129).

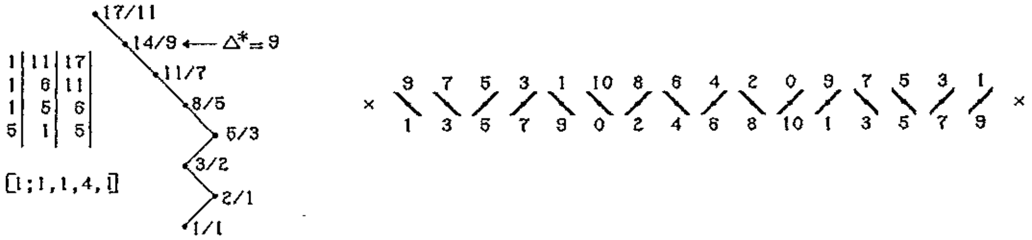

Fig. 1128 — Path in RKT and algorithm diagram of the $p/b = 17/11$ foundation knot.

The half-cycle braiding algorithms for the foundation knot can be read from its algorithm diagram in Fig. 1128 and are as follows:

1. : Free run.
2. $(i = 0)$: $(s)o$.
3. $(i = 0)$: o.
4. $(i \le 1)$: $(s)u - (1,s)2o$.
5. $(i \le 1)$: $u - 2o$.
6. $(i \le 2)$: $(1,s)2u - 2o$.
7. $(i \le 2)$: $2u - 2o$.
8. $(i \le 3)$: $(s)o - 2u - (1,s,1)3o$.
9. $(i \le 3)$: $o - 2u - 3o$.
10. $(i \le 4)$: $o - u - (s)o - u - 3o$.
11. $(i \le 4)$: $o - u - o - u - 3o$.
12. $(i \le 5)$: $(s,1)2o - u - o - u - o - (s)u - 2o$.
13. $(i \le 5)$: $2o - u - o - u - o - u - 2o$.
14. $(i \le 6)$: $2o - (1,s)2u - o - u - o - u - 2o$.
15. $(i \le 6)$: $2o - 2u - o - u - o - u - 2o$.
16. $(i \le 7)$: $(s)u - 2o - 2u - o - u - o - (s,1)2u - 2o$.
17. $(i \le 7)$: $u - 2o - 2u - o - u - o - 2u - 2o$.

18. $(i \leq 8)$: $u - 2o - u - (s)o - u - o - u - o - 2u - 2o$.
19. $(i \leq 8)$: $u - 2o - u - o - u - o - u - o - 2u - 2o$.
20. $(i \leq 9)$: $(s,1)2u - 2o - u - o - u - o - u - (1,s)2o - 2u - 2o$.
21. $(i \leq 9)$: $2u - 2o - u - o - u - o - u - 2o - 2u - 2o$.
22. $(i \leq 10)$: $2u - 2o - (1,s)2u - o - u - o - u - 2o - 2u - 2o$.

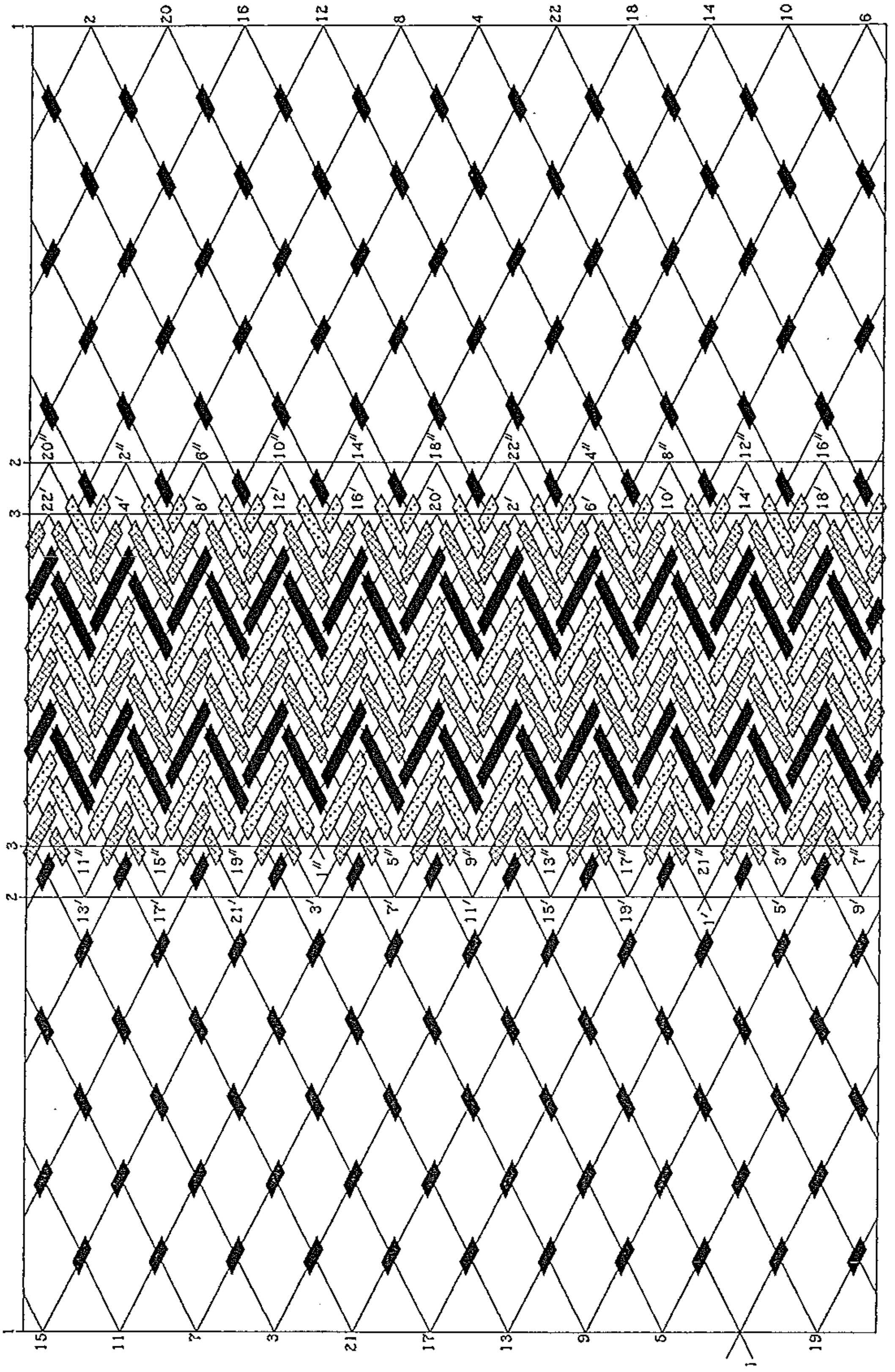

Fig. 1129 — Knot 4.

The half-cycle braiding algorithms for the half-cycles $1'$–$22'$ of the interbraided Regular Knot $p'/b = 5/11$ can be read from the upper algorithm diagram in Fig. 1130 and are as follows:

$1'$. : $o - u - o - u - o$.
$2'$. $(i = 0)$: $o - u - o - u - o$.
$3'$. $(i = 0)$: $o - u - o - u - o$.
$4'$. $(i \leq 1)$: $o - u - o - u - o$.
$5'$. $(i \leq 1)$: $o - u - o - u - o$.
$6'$. $(i \leq 2)$: $o - (s,1)2u - o - u - o$.
$7'$. $(i \leq 2)$: $o - 2u - o - u - o$.
$8'$. $(i \leq 3)$: $o - 2u - o - u - o$.
$9'$. $(i \leq 3)$: $o - 2u - o - u - o$.
$10'$. $(i \leq 4)$: $o - 2u - (s,1)2o - u - o$.
$11'$. $(i \leq 4)$: $o - 2u - 2o - u - o$.
$12'$. $(i \leq 5)$: $o - 2u - 2o - u - o$.
$13'$. $(i \leq 5)$: $o - 2u - 2o - u - o$.
$14'$. $(i \leq 6)$: $o - 2u - 2o - (s,1)2u - o$.
$15'$. $(i \leq 6)$: $o - 2u - 2o - 2u - o$.
$16'$. $(i \leq 7)$: $o - 2u - 2o - 2u - o$.
$17'$. $(i \leq 7)$: $o - 2u - 2o - 2u - o$.
$18'$. $(i \leq 8)$: $o - 2u - 2o - 2u - (s,1)2o$.
$19'$. $(i \leq 8)$: $o - 2u - 2o - 2u - 2o$.
$20'$. $(i \leq 9)$: $o - 2u - 2o - 2u - 2o$.
$21'$. $(i \leq 9)$: $o - 2u - 2o - 2u - 2o$.
$22'$. $(i \leq 10)$: $o - 2u - 2o - 2u - 2o$.

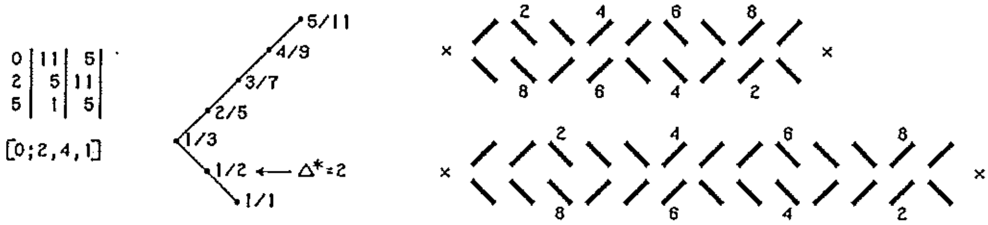

Fig. 1130 — The interbraided $p'/b = 5/11$ and $p''/b = 5/11$ Regular Knots.

The half-cycle braiding algorithms for the half-cycles $1''$–$22''$ of the interbraided Regular Knot $p''/b = 5/11$ can be read from the lower algorithm diagram in Fig. 1130 and are as follows:

$1''$. : $2o - 2u - 2o - 2u - o$.
$2''$. $(i = 0)$: $o - 2u - 2o - 2u - 2o$.
$3''$. $(i = 0)$: $2o - 2u - 2o - 2u - o$.
$4''$. $(i \leq 1)$: $o - 2u - 2o - 2u - 2o$.
$5''$. $(i \leq 1)$: $2o - 2u - 2o - 2u - o$.
$6''$. $(i \leq 2)$: $o - (s,2)3u - 2o - 2u - 2o$.
$7''$. $(i \leq 2)$: $2o - 3u - 2o - 2u - o$.
$8''$. $(i \leq 3)$: $o - 3u - 2o - 2u - 2o$.
$9''$. $(i \leq 3)$: $2o - 3u - 2o - 2u - o$.
$10''$. $(i \leq 4)$: $o - 3u - (s,2)3o - 2u - 2o$.
$11''$. $(i \leq 4)$: $2o - 3u - 3o - 2u - o$.
$12''$. $(i \leq 5)$: $o - 3u - 3o - 2u - 2o$.

13″. $(i \le 5)$: $2o - 3u - 3o - 2u - o$.
14″. $(i \le 6)$: $o - 3u - 3o - (s,2)3u - 2o$.
15″. $(i \le 6)$: $2o - 3u - 3o - 3u - o$.
16″. $(i \le 7)$: $o - 3u - 3o - 3u - 2o$.
17″. $(i \le 7)$: $2o - 3u - 3o - 3u - o$.
18″. $(i \le 8)$: $o - 3u - 3o - 3u - (s,2)3o$.
19″. $(i \le 8)$: $2o - 3u - 3o - 3u - 2o$.
20″. $(i \le 9)$: $o - 3u - 3o - 3u - 3o$.
21″. $(i \le 9)$: $2o - 3u - 3o - 3u - 2o$.
22″. $(i \le 10)$: $o - 3u - 3o - 3u - 3o$.

Knot 5.

The foundation knot (Regular Knot with $p/b = 19/11$) is centrally interbraided with two Regular Knots, each with $p/b = 7/11$ (see Fig. 1132).

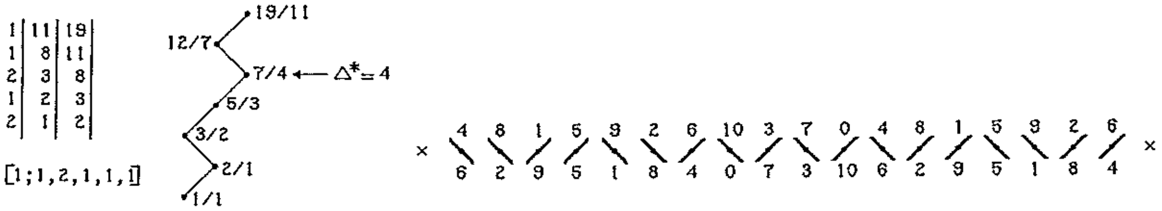

Fig. 1131 — Path in RKT and algorithm diagram of the $p/b = 19/11$ foundation knot.

The half-cycle braiding algorithms for the foundation knot can be read from its algorithm diagram in Fig. 1131 and are as follows:

1. : Free run.
2. $(i = 0)$: $(s)o$.
3. $(i = 0)$: o.
4. $(i \le 1)$: $(s,1,s)3o$.
5. $(i \le 1)$: $3o$.
6. $(i \le 2)$: $o - (s)u - (2,s)3o$.
7. $(i \le 2)$: $o - u - 3o$.
8. $(i \le 3)$: $o - u - (s,3)4o$.
9. $(i \le 3)$: $o - u - 4o$.
10. $(i \le 4)$: $(s)u - o - u - 2o - (s)u - 2o$.
11. $(i \le 4)$: $u - o - u - 2o - u - 2o$.
12. $(i \le 5)$: $u - (1,s)2o - u - 2o - u - o - (s)u - o$.
13. $(i \le 5)$: $u - 2o - u - 2o - u - o - u - o$.
14. $(i \le 6)$: $u - 2o - u - (s,2)3o - u - o - u - (1,s)2o$.
15. $(i \le 6)$: $u - 2o - u - 3o - u - o - u - 2o$.
16. $(i \le 7)$: $u - 2o - u - 2o - (s)u - o - u - o - u - 2o$.
17. $(i \le 7)$: $u - 2o - u - 2o - u - o - u - o - u - 2o$.
18. $(i \le 8)$: $(1,s)2u - 2o - u - 2o - u - o - u - (s,1)2o - u - 2o$.
19. $(i \le 8)$: $2u - 2o - u - 2o - u - o - u - 2o - u - 2o$.
20. $(i \le 9)$: $2u - 2o - (s,1)2u - 2o - u - o - u - 2o - (1,s)2u - 2o$.
21. $(i \le 9)$: $2u - 2o - 2u - 2o - u - o - u - 2o - 2u - 2o$.
22. $(i \le 10)$: $2u - 2o - 2u - o - (s)u - o - u - o - u - 2o - 2u - 2o$.

The half-cycle braiding algorithms for the half-cycles 1′–22′ of the interbraided Regular Knot $p'/b = 7/11$ can be read from the upper algorithm diagram in Fig. 1133.

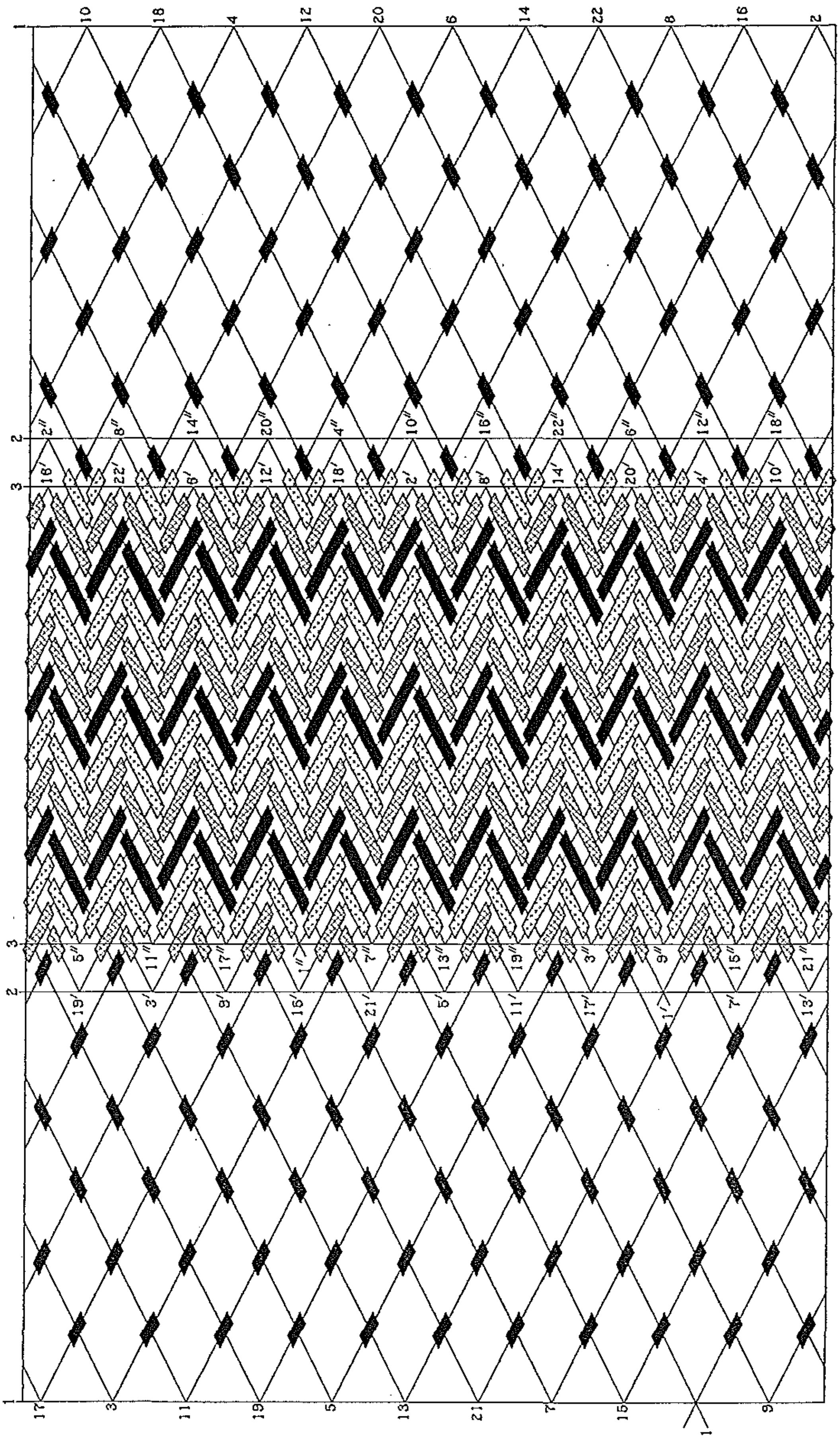

Fig. 1132 — Knot 5.

Hence for the half-cycle braiding algorithms $1'$–$22'$ we obtain:

$1'$. : $o - u - o - u - o - u - o$.
$2'$. $(i = 0)$: $o - u - o - u - o - u - o$.
$3'$. $(i = 0)$: $o - u - o - u - o - u - o$.
$4'$. $(i \leq 1)$: $o - u - o - u - (s,1)2o - u - o$.
$5'$. $(i \leq 1)$: $o - u - o - u - 2o - u - o$.
$6'$. $(i \leq 2)$: $o - u - o - u - 2o - u - o$.
$7'$. $(i \leq 2)$: $o - u - o - u - 2o - u - o$.
$8'$. $(i \leq 3)$: $o - (s,1)2u - o - u - 2o - u - o$.
$9'$. $(i \leq 3)$: $o - 2u - o - u - 2o - u - o$.
$10'$. $(i \leq 4)$: $o - 2u - o - u - 2o - (s,1)2u - o$.
$11'$. $(i \leq 4)$: $o - 2u - o - u - 2o - 2u - o$.
$12'$. $(i \leq 5)$: $o - 2u - o - u - 2o - 2u - o$.
$13'$. $(i \leq 5)$: $o - 2u - o - u - 2o - 2u - o$.
$14'$. $(i \leq 6)$: $o - 2u - (s,1)2o - u - 2o - 2u - o$.
$15'$. $(i \leq 6)$: $o - 2u - 2o - u - 2o - 2u - o$.
$16'$. $(i \leq 7)$: $o - 2u - 2o - u - 2o - 2u - (s,1)2o$.
$17'$. $(i \leq 7)$: $o - 2u - 2o - u - 2o - 2u - 2o$.
$18'$. $(i \leq 8)$: $o - 2u - 2o - u - 2o - 2u - 2o$.
$19'$. $(i \leq 8)$: $o - 2u - 2o - u - 2o - 2u - 2o$.
$20'$. $(i \leq 9)$: $o - 2u - 2o - (s,1)2u - 2o - 2u - 2o$.
$21'$. $(i \leq 9)$: $o - 2u - 2o - 2u - 2o - 2u - 2o$.
$22'$. $(i \leq 10)$: $o - 2u - 2o - 2u - 2o - 2u - 2o$.

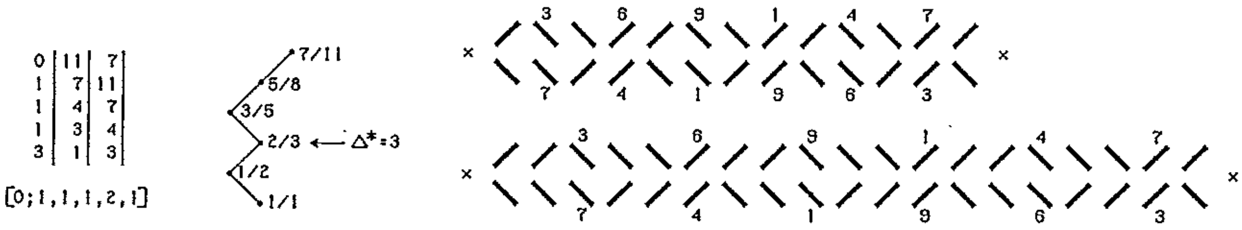

Fig. 1133 — The interbraided $p'/b = 7/11$ and $p''/b = 7/11$ Regular Knots.

The half-cycle braiding algorithms for the half-cycles $1''$–$22''$ of the interbraided Regular Knot $p''/b = 7/11$ can be read from the lower algorithm diagram in Fig. 1133 and are as follows:

$1''$. : $2o - 2u - 2o - 2u - 2o - 2u - o$.
$2''$. $(i = 0)$: $o - 2u - 2o - 2u - 2o - 2u - 2o$.
$3''$. $(i = 0)$: $2o - 2u - 2o - 2u - 2o - 2u - o$.
$4''$. $(i \leq 1)$: $o - 2u - 2o - 2u - (s,2)3o - 2u - 2o$.
$5''$. $(i \leq 1)$: $2o - 2u - 2o - 2u - 3o - 2u - o$.
$6''$. $(i \leq 2)$: $o - 2u - 2o - 2u - 3o - 2u - 2o$.
$7''$. $(i \leq 2)$: $2o - 2u - 2o - 2u - 3o - 2u - o$.
$8''$. $(i \leq 3)$: $o - (s,2)3u - 2o - 2u - 3o - 2u - 2o$.
$9''$. $(i \leq 3)$: $2o - 3u - 2o - 2u - 3o - 2u - o$.
$10''$. $(i \leq 4)$: $o - 3u - 2o - 2u - 3o - (s,2)3u - 2o$.
$11''$. $(i \leq 4)$: $2o - 3u - 2o - 2u - 3o - 3u - o$.
$12''$. $(i \leq 5)$: $o - 3u - 2o - 2u - 3o - 3u - 2o$.
$13''$. $(i \leq 5)$: $2o - 3u - 2o - 2u - 3o - 3u - o$.
$14''$. $(i \leq 6)$: $o - 3u - (s,2)3o - 2u - 3o - 3u - 2o$.

$15''$. $(i \le 6)$: $2o - 3u - 3o - 2u - 3o - 3u - o$.
$16''$. $(i \le 7)$: $o - 3u - 3o - 2u - 3o - 3u - (s,2)3o$.
$17''$. $(i \le 7)$: $2o - 3u - 3o - 2u - 3o - 3u - 2o$.
$18''$. $(i \le 8)$: $o - 3u - 3o - 2u - 3o - 3u - 3o$.
$19''$. $(i \le 8)$: $2o - 3u - 3o - 3u - 2o$.
$20''$. $(i \le 9)$: $o - 3u - 3o - (s,2)3u - 3o - 3u - 3o$.
$21''$. $(i \le 9)$: $2o - 3u - 3o - 3u - 3o - 3u - 2o$.
$22''$. $(i \le 10)$: $o - 3u - 3o - 3u - 3o - 3u - 3o$.

The following knots 6 (see Fig. 1134) and 7 (see Fig. 1135) are variations of respectively knot 4 (Fig. 1129) and knot 5 (Fig. 1132). The non interbraided two-pass column-coded sections in the knots 4 and 5 have been replaced by non interbraided three-pass column-coded sections which gives them a somewhat preferred appearance.

Knot 6.

The foundation knot (Regular Knot with $p/b = 23/11$) is centrally interbraided with two Regular Knots, each with $p/b = 5/11$ (see Fig. 1134). Knot 6 is a variation of knot 4.

The half-cycle braiding algorithms for the foundation knot can be read from its algorithm diagram in Fig. 1134 and are as follows:

1. : Free run.
2. $(i = 0)$: $(s)u - (s)o$.
3. $(i = 0)$: $u - o$.
4. $(i \le 1)$: $(s)o - u - (s,1)2o$.
5. $(i \le 1)$: $o - u - 2o$.
6. $(i \le 2)$: $(s)u - o - u - (s,2)3o$.
7. $(i \le 2)$: $u - o - u - 3o$.
8. $(i \le 3)$: $(s,1)2u - o - (1,s)2u - 3o$.
9. $(i \le 3)$: $2u - o - 2u - 3o$.
10. $(i \le 4)$: $(s,2)3u - o - (1,s,1)3u - 3o$.
11. $(i \le 4)$: $3u - o - 3u - 3o$.
12. $(i \le 5)$: $(s)o - 3u - o - (1,s,2)4u - 3o$.
13. $(i \le 5)$: $o - 3u - o - 4u - 3o$.
14. $(i \le 6)$: $(s,1)2o - 3u - o - u - (s)o - 3u - 3o$.
15. $(i \le 6)$: $2o - 3u - o - u - o - 3u - 3o$.
16. $(i \le 7)$: $(s,2)3o - 3u - o - u - (s,1)2o - 3u - 3o$.
17. $(i \le 7)$: $3o - 3u - o - u - 2o - 3u - 3o$.
18. $(i \le 8)$: $(s)u - 3o - 3u - o - u - (s,2)3o - 3u - 3o$.
19. $(i \le 8)$: $u - 3o - 3u - o - u - 3o - 3u - 3o$.
20. $(i \le 9)$: $(s,1)2u - 3o - 3u - o - (1,s)2u - 3o - 3u - 3o$.
21. $(i \le 9)$: $2u - 3o - 3u - o - 2u - 3o - 3u - 3o$.
22. $(i \le 10)$: $(s,2)3u - 3o - 3u - o - u - (s)o - u - 3o - 3u - 3o$.

The half-cycle braiding algorithms for the half-cycles $1'$–$22'$ of the interbraided Regular Knot $p'/b = 5/11$ are identical to the half-cycle braiding algorithms for the half-cycles $1'$–$22'$ of the interbraided Regular Knot $p'/b = 5/11$ in knot 4.

The half-cycle braiding algorithms for the half-cycles $1''$–$22''$ of the interbraided Regular Knot $p'/b = 5/11$ are identical to the half-cycle braiding algorithms for the half-cycles $1''$–$22''$ of the interbraided Regular Knot $p'/b = 5/11$ in knot 4.

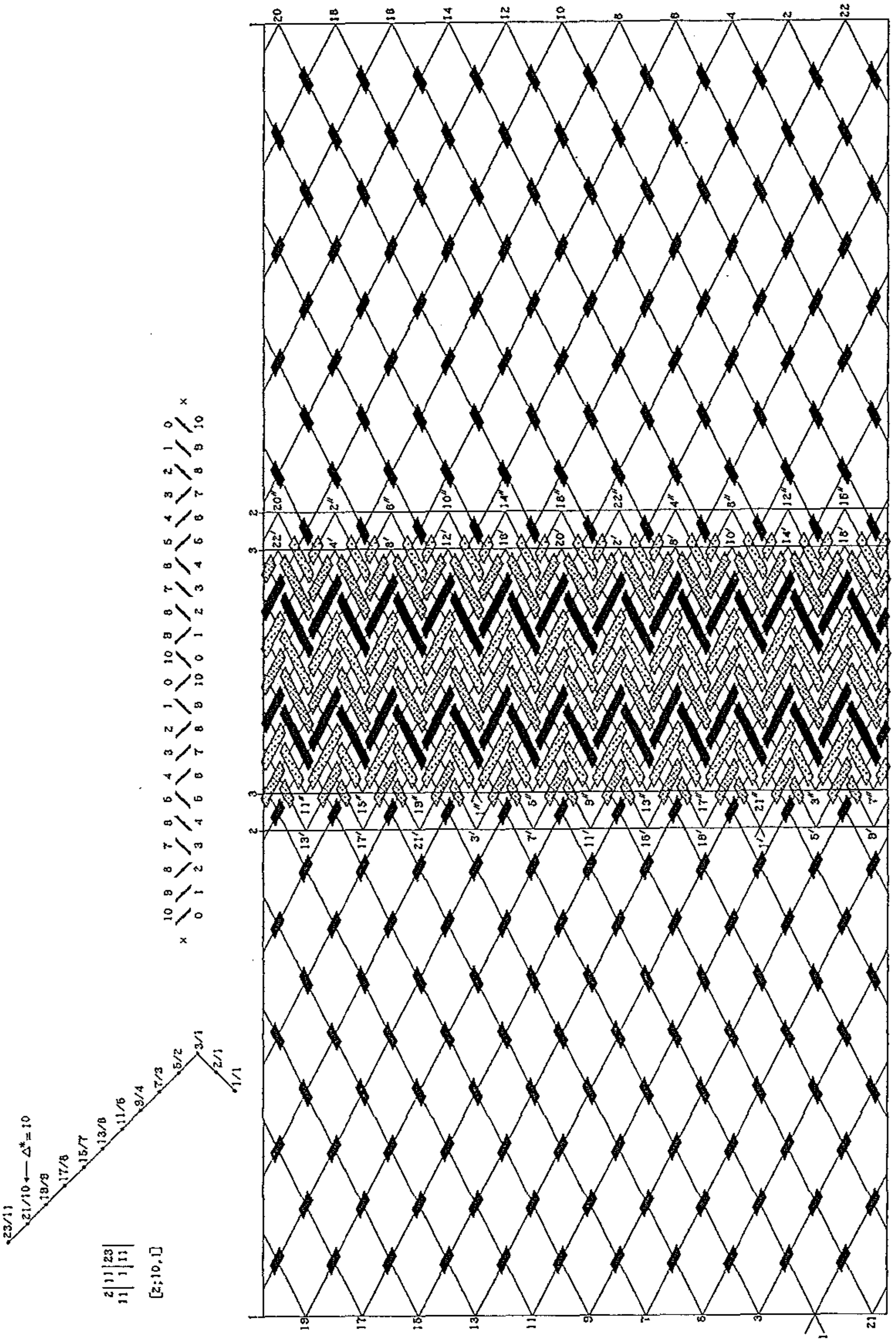

Fig. 1134 — Knot 6.

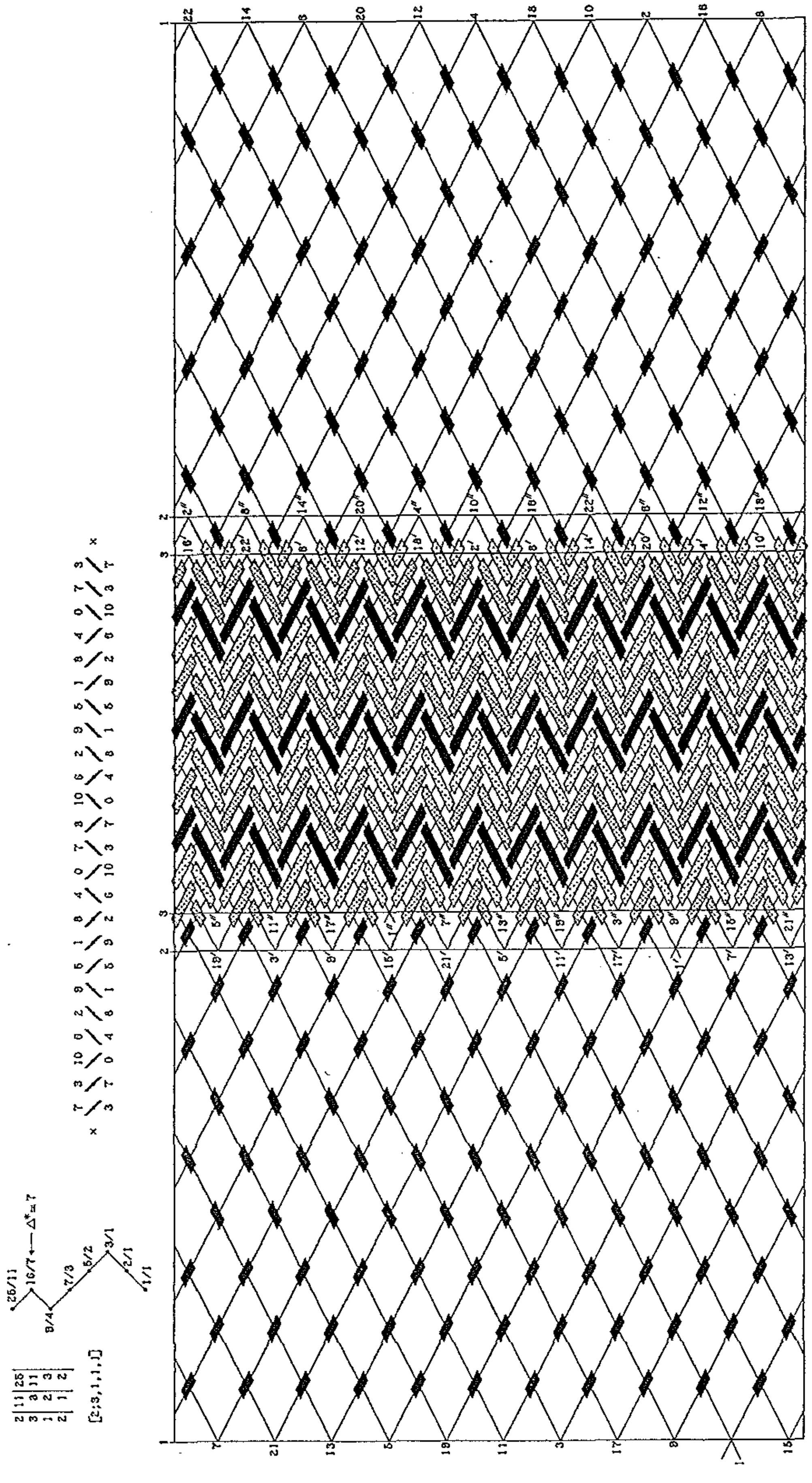

Fig. 1135 — Knot 7.

Knot 7.

The foundation knot (Regular Knot with $p/b = 25/11$) is centrally interbraided with two Regular Knots, each with $p/b = 7/11$ (see Fig. 1135). Knot 7 is a variation of knot 5.

The half-cycle braiding algorithms for the foundation knot can be read from its algorithm diagram in Fig. 1135 and are as follows:

1. : Free run.
2. $(i = 0)$: $(s)u - (s)o$.
3. $(i = 0)$: $u - o$.
4. $(i \leq 1)$: $(s,1,s)3u - o$.
5. $(i \leq 1)$: $3u - o$.
6. $(i \leq 2)$: $(s)o - 2u - (s)o - u - o$.
7. $(i \leq 2)$: $o - 2u - o - u - o$.
8. $(i \leq 3)$: $(s)u - o - (2,s)3u - o - u - (1,s)2o$.
9. $(i \leq 3)$: $u - o - 3u - o - u - 2o$.
10. $(i \leq 4)$: $u - o - u - (s)o - 2u - o - (1,s)2u - 2o$.
11. $(i \leq 4)$: $u - o - u - o - 2u - o - 2u - 2o$.
12. $(i \leq 5)$: $u - o - (s,1)2u - o - 2u - (1,s)2o - 2u - 2o$.
13. $(i \leq 5)$: $u - o - 2u - o - 2u - 2o - 2u - 2o$.
14. $(i \leq 6)$: $u - (s,1)2o - 2u - o - (2,s)3u - 2o - 2u - 2o$.
15. $(i \leq 6)$: $u - 2o - 2u - o - 3u - 2o - 2u - 2o$.
16. $(i \leq 7)$: $(s,1)2u - 2o - 2u - o - u - (s)o - 2u - 2o - 2u - (1,s,1)3o$.
17. $(i \leq 7)$: $2u - 2o - 2u - o - u - o - 2u - 2o - 2u - 3o$.
18. $(i \leq 8)$: $2u - 2o - (2,s)3u - o - u - o - 2u - 2o - (1,s,1)3u - 3o$.
19. $(i \leq 8)$: $2u - 2o - 3u - o - u - o - 2u - 2o - 3u - 3o$.
20. $(i \leq 9)$: $2u - (2,s)3o - 3u - o - u - o - 2u - (1,s,1)3o - 3u - 3o$.
21. $(i \leq 9)$: $2u - 3o - 3u - o - u - o - 2u - 3o - 3u - 3o$.
22. $(i \leq 10)$: $(2,s)3u - 3o - 3u - o - u - o - u - (s)o - u - 3o - 3u - 3o$.

The half-cycle braiding algorithms for the half-cycles $1'$–$22'$ of the interbraided Regular Knot $p'/b = 7/11$ are identical to the half-cycle braiding algorithms for the half-cycles $1'$–$22'$ of the interbraided Regular Knot $p'/b = 7/11$ in knot 5.

The half-cycle braiding algorithms for the half-cycles $1''$–$22''$ of the interbraided Regular Knot $p'/b = 7/11$ are identical to the half-cycle braiding algorithms for the half-cycles $1''$–$22''$ of the interbraided Regular Knot $p'/b = 7/11$ in knot 5.

Knot 8.

The upper grid-diagram in Fig. 1136 depicts the foundation knot which is centrally interbraided with two Regular knots, each with $p/b = 5/7$. The first-return string-run of the foundation knot has been depicted in Fig. 1051, pg. 1309 of *The Braider*, Issue No. 55, with $C_1 = C_3 = 10$ and $C_2 = 9$. Hence $3C_1 + C_2 + 3C_3 = 30 + 9 + 30 = 69 = \beta'$ associated with circumferential bight-boundary L_1 and hence with $\alpha' = 3$. With $\alpha = 5$ and $\alpha' = 3$ we obtain $\beta = \dfrac{\beta' \cdot \alpha}{\alpha'} = \dfrac{69 \times 5}{3} = 115$, and consequently $\dfrac{\beta}{\alpha} = \dfrac{\beta'}{\alpha'} = \dfrac{115}{5} = \dfrac{69}{3} = 23$. For $\lambda = 1$, $\dfrac{B_c{}'}{\alpha'} = \dfrac{B_c{}'}{3}$ on bight-boundary L_1 must be coprime with 23. $\dfrac{B_c{}'}{3} = 7$ and hence $B_c{}' = 3 \times 7 = 21$ on bight-boundary L_1 fulfils this condition.

Note that this foundation knot has $B_c = 7 \times \alpha = 7 \times 5 = 35$ bights.

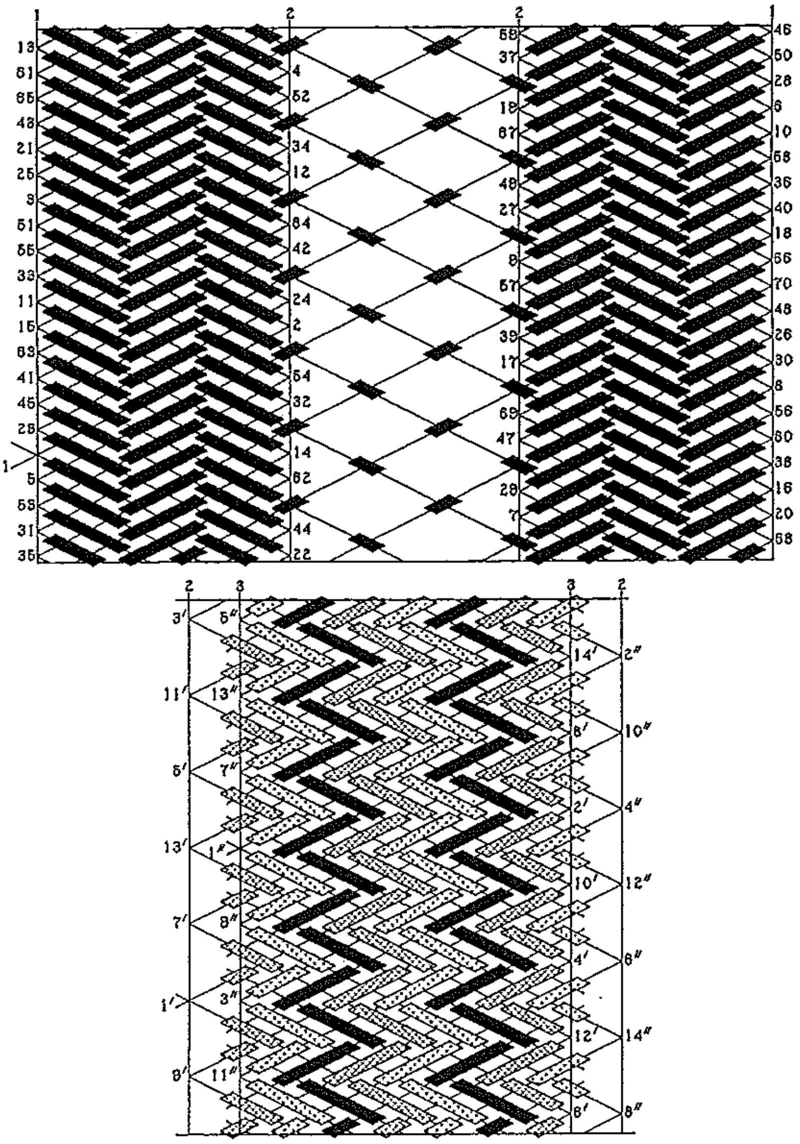

Fig. 1136 — Knot 8.

The half-cycle braiding algorithms for the foundation knot can be read from the tables in Fig. 1137 and Fig. 1138 as follows:

1. $L_1 \longrightarrow R_2$: Free run.
2. $R_2 \longrightarrow L_1$: Free run.
3. $L_1 \longrightarrow R_2$: Free run.
4. $R_2 \longrightarrow L_1$: Free run.
5. $L_1 \longrightarrow R_1$: Free run.
6. $R_1 \longrightarrow L_2$: Free run.
7. $L_2 \longrightarrow R_1$: Free run.
8. $R_1 \longrightarrow L_2$: Free run.
9. $L_2 \longrightarrow R_1$: Free run.
10. $R_1 \longrightarrow L_1$: $u - o - u$.
11. $L_1 \longrightarrow R_2$: o.
12. $R_2 \longrightarrow L_1$: u.
13. $L_1 \longrightarrow R_2$: o.
14. $R_2 \longrightarrow L_1$: $2u$.

15. $L_1 \longrightarrow R_1$: $u - 2o - u$.
16. $R_1 \longrightarrow L_2$: o .
17. $L_2 \longrightarrow R_1$: u .
18. $R_1 \longrightarrow L_2$: $2o$.
19. $L_2 \longrightarrow R_1$: $2u$.
20. $R_1 \longrightarrow L_1$: $u - 3o - u - o$.
21. $L_1 \longrightarrow R_2$: $o - u$.
22. $R_2 \longrightarrow L_1$: $u - 2o$.
23. $L_1 \longrightarrow R_2$: $2o - u$.
24. $R_2 \longrightarrow L_1$: $2u - o$.

HALF-CYCLE									
1	23	45	41	63	15	11	33	55	51
11	33	55	51	3	25	21	43	65	61
21	43	65	61	13	35	31	53	5	X
31	53	5	X	23	45	41	63	15	11
41	63	15	11	33	55	51	3	25	21
51	3	25	21	43	65	61	13	35	31
61	13	35	31	53	5	X	23	45	41
	U	U	U	O	O	O	U	U	U

HALF-CYCLE									
3	25	21	43	65	61	13	35	31	53
13	35	31	53	5	X	23	45	41	63
23	45	41	63	15	11	33	55	51	3
33	55	51	3	25	21	43	65	61	13
43	65	61	13	35	31	53	5	X	23
53	5	X	23	45	41	63	15	11	33
63	15	11	33	55	51	3	25	21	43
	U	U	U	O	O	O	U	U	U

HALF-CYCLE									
7	29	51	47	69	21	17	39	61	57
17	39	61	57	9	31	27	49	X	67
27	49	X	67	19	41	37	59	11	7
37	59	11	7	29	51	47	69	21	17
47	69	21	17	39	61	57	9	31	27
57	9	31	27	49	X	67	19	41	37
67	19	41	37	59	11	7	29	51	47
	O	O	O	U	U	U	O	O	O

HALF-CYCLE									
9	31	27	49	X	67	19	41	37	59
19	41	37	59	11	7	29	51	47	69
29	51	47	69	21	17	39	61	57	9
39	61	57	9	31	27	49	X	67	19
49	X	67	19	41	37	59	11	7	29
59	11	7	29	51	47	69	21	17	39
69	21	17	39	61	57	9	31	27	49
	O	O	O	U	U	U	O	O	O

HALF-CYCLE																						
5	X	23	45	41	63	15	11	33	55	51	21	61	31	27	49	X	67	19	41	37	59	11
15	11	33	55	51	3	25	21	43	65	61	31	X	41	37	59	11	7	29	51	47	69	21
25	21	43	65	61	13	35	31	53	5	X	41	11	51	47	69	21	17	39	61	57	9	31
35	31	53	5	X	23	45	41	63	15	11	51	21	61	57	9	31	27	49	X	67	19	41
45	41	63	15	11	33	55	51	3	25	21	61	31	X	67	19	41	37	59	11	7	29	51
55	51	3	25	21	43	65	61	13	35	31	X	41	11	7	29	51	47	69	21	17	39	61
65	61	13	35	31	53	5	X	23	45	41	11	51	21	17	39	61	57	9	31	27	49	X
	U	U	U	O	O	O	U	U	U	O	U	O	U	O	O	O	U	U	U	O	O	O

Fig. 1137 —Tables for the odd-numbered half-cycles.

25. $L_1 \longrightarrow R_1$: $u - o - u - 2o - u - o$.
26. $R_1 \longrightarrow L_2$: $o - 2u$.
27. $L_2 \longrightarrow R_1$: $u - 2o$.
28. $R_1 \longrightarrow L_2$: $2o - u$.
29. $L_2 \longrightarrow R_1$: $2u - o$.
30. $R_1 \longrightarrow L_1$: $u - o - u - 4o - u - o$.
31. $L_1 \longrightarrow R_2$: $u - o - 2u$.

32. $R_2 \longrightarrow L_1$: $2o - u - 2o$.
33. $L_1 \longrightarrow R_2$: $u - 2o - u$.
34. $R_2 \longrightarrow L_1$: $o - 2u - o$.
35. $L_1 \longrightarrow R_1$: $2u - o - u - 4o - u - o$.
36. $R_1 \longrightarrow L_2$: $2u - o - 2u$.
37. $L_2 \longrightarrow R_1$: $2o - u - 2o$.
38. $R_1 \longrightarrow L_2$: $u - 2o - u$.
39. $L_2 \longrightarrow R_1$: $o - 2u - o$.

HALF-CYCLE									
2	24	46	42	64	16	12	34	56	52
12	34	56	52	4	26	22	44	66	62
22	44	66	62	14	36	32	54	6	2
32	54	6	2	24	46	42	64	16	12
42	64	16	12	34	56	52	4	26	22
52	4	26	22	44	66	62	14	36	32
62	14	36	32	54	6	2	24	46	42
	O	O	O	U	U	U	O	O	O

HALF-CYCLE									
4	26	22	44	66	62	14	36	32	54
14	36	32	54	6	2	24	46	42	64
24	46	42	64	16	12	34	56	52	4
34	56	52	4	26	22	44	66	62	14
44	66	62	14	36	32	54	6	2	24
54	6	2	24	46	42	64	16	12	34
64	16	12	34	56	52	4	26	22	44
	O	O	O	U	U	U	O	O	O

HALF-CYCLE									
6	28	50	46	68	20	16	38	60	56
16	38	60	56	8	30	26	48	70	66
26	48	70	66	18	40	36	58	10	6
36	58	10	6	28	50	46	68	20	16
46	68	20	16	38	60	56	8	30	26
56	8	30	26	48	70	66	18	40	36
66	18	40	36	58	10	6	28	50	46
	U	U	U	O	O	O	U	U	U

HALF-CYCLE									
8	30	26	48	70	66	18	40	36	58
18	40	36	58	10	6	28	50	46	68
28	50	46	68	20	16	38	60	56	8
38	60	56	8	30	26	48	70	66	18
48	70	66	18	40	36	58	10	6	28
58	10	6	28	50	46	68	20	16	38
68	20	16	38	60	56	8	30	26	48
	U	U	U	O	O	O	U	U	U

HALF-CYCLE																						
10	6	28	50	46	68	20	16	38	60	56	26	66	36	32	54	6	2	24	46	42	64	16
20	16	38	60	56	8	30	26	48	70	66	36	6	46	42	64	16	12	34	56	52	4	26
30	26	48	70	66	18	40	36	58	10	6	46	16	56	52	4	26	22	44	66	62	14	36
40	36	58	10	6	28	50	46	68	20	16	56	26	66	62	14	36	32	54	6	2	24	46
50	46	68	20	16	38	60	56	8	30	26	66	36	6	2	24	46	42	64	16	12	34	56
60	56	8	30	26	48	70	66	18	40	36	6	46	16	12	34	56	52	4	26	22	44	66
70	66	18	40	36	58	10	6	28	50	46	16	56	26	22	44	66	62	14	36	32	54	6
	U	U	U	O	O	O	U	U	U	O	U	O	U	O	O	O	U	U	U	O	O	O

Fig. 1138 —Tables for the even-numbered half-cycles.

40. $R_1 \longrightarrow L_1$: $2u - 2o - u - 4o - 2u - 2o$.
41. $L_1 \longrightarrow R_2$: $2u - o - 3u$.
42. $R_2 \longrightarrow L_1$: $2o - u - 3o$.
43. $L_1 \longrightarrow R_2$: $u - 2o - 2u$.
44. $R_2 \longrightarrow L_1$: $o - 2u - 3o$.
45. $L_1 \longrightarrow R_1$: $2u - 2o - 2u - 4o - 2u - 2o$.
46. $R_1 \longrightarrow L_2$: $2u - o - 3u$.
47. $L_2 \longrightarrow R_1$: $2o - u - 3o$.
48. $R_1 \longrightarrow L_2$: $u - 2o - 3u$.

49. $L_2 \longrightarrow R_1$: $o - 2u - 3o$.
50. $R_1 \longrightarrow L_1$: $2u - 2o - 2u - 2o - u - 3o - 2u - 2o$.
51. $L_1 \longrightarrow R_2$: $3u - o - 3u$.
52. $R_2 \longrightarrow L_1$: $3o - u - 3o$.
53. $L_1 \longrightarrow R_2$: $2u - 2o - 3u$.
54. $R_2 \longrightarrow L_1$: $3o - 2u - 3o$.
55. $L_1 \longrightarrow R_1$: $3u - 2o - 2u - 2o - u - 3o - 2u - 2o$.
56. $R_1 \longrightarrow L_2$: $3u - o - 3u$.
57. $L_2 \longrightarrow R_1$: $3o - u - 3o$.
58. $R_1 \longrightarrow L_2$: $3u - 2o - 3u$.
59. $L_2 \longrightarrow R_1$: $3o - 2u - 3o$.
60. $R_1 \longrightarrow L_1$: $3u - 2o - 2u - o - u - o - u - 3o - 3u - 2o$.
61. $L_1 \longrightarrow R_2$: $3u - 2o - 3u$.
62. $R_2 \longrightarrow L_1$: $3o - 3u - 3o$.
63. $L_1 \longrightarrow R_2$: $3u - 3o - 3u$.
64. $R_2 \longrightarrow L_1$: $3o - 3u - 3o$.
65. $L_1 \longrightarrow R_1$: $3u - 3o - 2u - o - u - o - u - 3o - 3u - 2o$.
66. $R_1 \longrightarrow L_2$: $3u - 3o - 3u$.
67. $L_2 \longrightarrow R_1$: $3o - 3u - 3o$.
68. $R_1 \longrightarrow L_2$: $3u - 3o - 3u$.
69. $L_2 \longrightarrow R_1$: $3o - 3u - 3o$.
70. $R_1 \longrightarrow L_1$: $3u - 3o - 3u - o - u - o - u - 3o - 3u - 3o$.

The half-cycle braiding algorithms for the half-cycles $1'$–$14'$ of the interbraided Regular Knot $p'/b = 5/7$ can be read from the upper algorithm diagram in Fig. 1139 and are as follows:

$1'$. : $o - u - o - u - o$.
$2'$. $(i = 0)$: $o - u - o - u - o$.
$3'$. $(i = 0)$: $o - u - o - u - o$.
$4'$. $(i \leq 1)$: $o - u - (s,1)2o - u - o$.
$5'$. $(i \leq 1)$: $o - u - 2o - u - o$.
$6'$. $(i \leq 2)$: $o - u - 2o - u - (s,1)2o$.
$7'$. $(i \leq 2)$: $o - u - 2o - u - 2o$.
$8'$. $(i \leq 3)$: $o - u - 2o - u - 2o$.
$9'$. $(i \leq 3)$: $o - u - 2o - u - 2o$.
$10'$. $(i \leq 4)$: $o - (s,1)2u - 2o - u - 2o$.
$11'$. $(i \leq 4)$: $o - 2u - 2o - u - 2o$.
$12'$. $(i \leq 5)$: $o - 2u - 2o - (s,1)2u - 2o$.
$13'$. $(i \leq 5)$: $o - 2u - 2o - 2u - 2o$.
$14'$. $(i \leq 6)$: $o - 2u - 2o - 2u - 2o$.

The half-cycle braiding algorithms for the half-cycles $1''$–$14''$ of the interbraided Regular Knot $p''/b = 5/7$ can be read from the lower algorithm diagram in Fig. 1139 and are as follows:

$1''$. : $2o - 2u - 2o - 2u - o$.
$2''$. $(i = 0)$: $o - 2u - 2o - 2u - 2o$.
$3''$. $(i = 0)$: $2o - 2u - 2o - 2u - o$.
$4''$. $(i \leq 1)$: $o - 2u - (s,2)3o - 2u - 2o$.
$5''$. $(i \leq 1)$: $2o - 2u - 3o - 2u - o$.

6″. $(i \le 2)$: $o - 2u - 3o - 2u - (s,2)3o.$
7″. $(i \le 2)$: $2o - 2u - 3o - 2u - 2o.$
8″. $(i \le 3)$: $o - 2u - 3o - 2u - 3o.$
9″. $(i \le 3)$: $2o - 2u - 3o - 2u - 2o.$
10″. $(i \le 4)$: $o - (s,2)3u - 3o - 2u - 3o.$
11″. $(i \le 4)$: $2o - 3u - 3o - 2u - 2o.$
12″. $(i \le 5)$: $o - 3u - 3o - (s,2)3u - 3o.$
13″. $(i \le 5)$: $2o - 3u - 3o - 3u - 2o.$
14″. $(i \le 6)$: $o - 3u - 3o - 3u - 3o.$

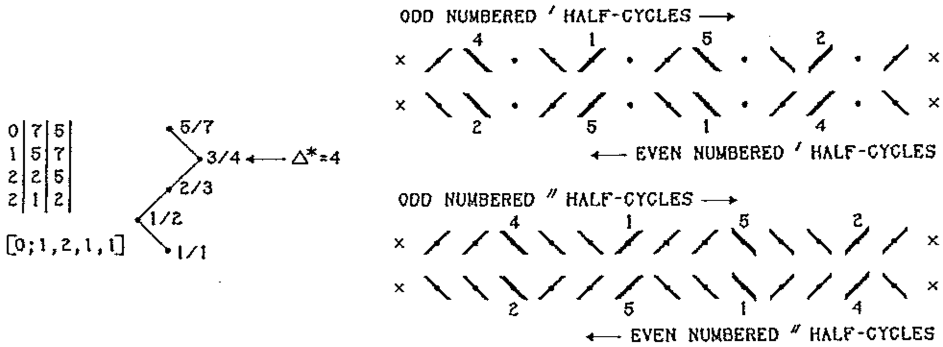
ODD NUMBERED ′ HALF-CYCLES ⟶
4 1 5 2
2 5 1 4
⟵ EVEN NUMBERED ′ HALF-CYCLES
ODD NUMBERED ″ HALF-CYCLES ⟶
4 1 5 2
2 5 1 4
⟵ EVEN NUMBERED ″ HALF-CYCLES
0 7 5
1 5 7
2 2 5
2 1 2
[0;1,2,1,1]
5/7
3/4
Δ*=4
2/3
1/2
1/1

Fig. 1139 — The interbraided $p'/b = 5/7$ and $p''/b = 5/7$ Regular Knots.

In Fig. 1140 the braid of the foundation knot starts at the centre of its string-length.

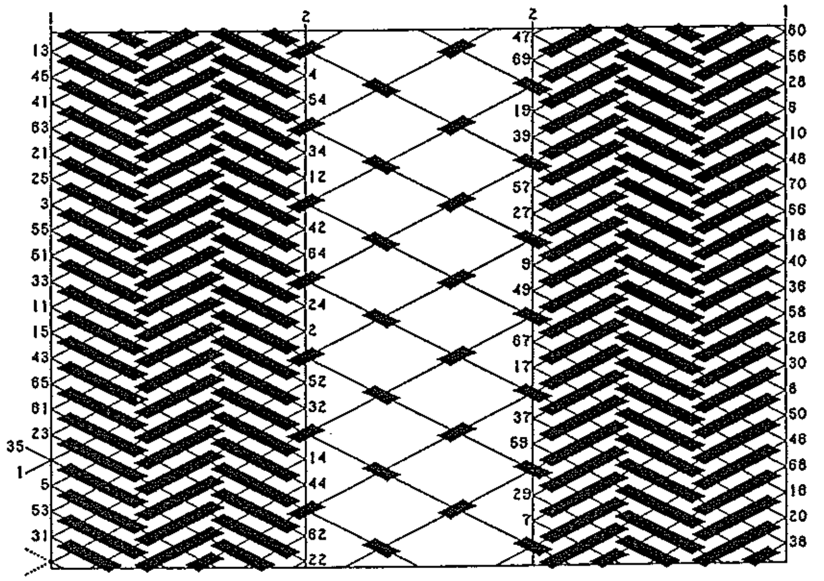

Fig. 1140 — Starting the foundation knot braid at the centre of its string-length.

The half-cycle braiding algorithms for the half-cycles 1–34 of the foundation knot can be read as before from the tables in Fig. 1137 and Fig. 1138. The half-cycle braiding algorithms for the half-cycles 35–70 of the foundation knot can be read from the tables in Fig. 1141 and Fig. 1142 and are as follows:†

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† The numerical entries in the tables of Figs. 1137 & 1138 and in Figs. 1141 & 1142 are respectively the same since half-cycle 35 in Fig. 1140 occupies a similar position as half-cycle 35 in Fig. 1136. The tables in Figs. 1141 & 1142 belong to the complete string-run which starts at the end of half-cycle 34 in Fig. 1136, running from upper left bight-boundary to lower right bight-boundary.

35. $L_1 \longrightarrow R_1$: $2o - u - o - 4u - o - u$.
36. $R_1 \longrightarrow L_2$: $2o - u - 2o$.
37. $L_2 \longrightarrow R_1$: $2u - o - 2u$.
38. $R_1 \longrightarrow L_2$: $o - 2u - o$.
39. $L_2 \longrightarrow R_1$: $u - 2o - u$.

HALF-CYCLE									
1	23	45	41	63	15	11	33	55	51
11	33	55	51	3	25	21	43	65	61
21	43	65	61	13	35	31	53	5	X
31	53	5	X	23	45	41	63	15	11
41	63	15	11	33	55	51	3	25	21
51	3	25	21	43	65	61	13	35	31
61	13	35	31	53	5	X	23	45	41
	O	O	O	U	U	U	O	O	O

HALF-CYCLE									
3	25	21	43	65	61	13	35	31	53
13	35	31	53	5	X	23	45	41	63
23	45	41	63	15	11	33	55	51	3
33	55	51	3	25	21	43	65	61	13
43	65	61	13	35	31	53	5	X	23
53	5	X	23	45	41	63	15	11	33
63	15	11	33	55	51	3	25	21	43
	O	O	O	U	U	U	O	O	O

HALF-CYCLE									
7	29	51	47	69	21	17	39	61	57
17	39	61	57	9	31	27	49	X	67
27	49	X	67	19	41	37	59	11	7
37	59	11	7	29	51	47	69	21	17
47	69	21	17	39	61	57	9	31	27
57	9	31	27	49	X	67	19	41	37
67	19	41	37	59	11	7	29	51	47
	U	U	U	O	O	O	U	U	U

HALF-CYCLE									
9	31	27	49	X	67	19	41	37	59
19	41	37	59	11	7	29	51	47	69
29	51	47	69	21	17	39	61	57	9
39	61	57	9	31	27	49	X	67	19
49	X	67	19	41	37	59	11	7	29
59	11	7	29	51	47	69	21	17	39
69	21	17	39	61	57	9	31	27	49
	U	U	U	O	O	O	U	U	U

HALF-CYCLE																						
5	X	23	45	41	63	15	11	33	55	51	21	61	31	27	49	X	67	19	41	37	59	11
15	11	33	55	51	3	25	21	43	65	61	31	X	41	37	59	11	7	29	51	47	69	21
25	21	43	65	61	13	35	31	53	5	X	41	11	51	47	69	21	17	39	61	57	9	31
35	31	53	5	X	23	45	41	63	15	11	51	21	61	57	9	31	27	49	X	67	19	41
45	41	63	15	11	33	55	51	3	25	21	61	31	X	67	19	41	37	59	11	7	29	51
55	51	3	25	21	43	65	61	13	35	31	X	41	11	7	29	51	47	69	21	17	39	61
65	61	13	35	31	53	5	X	23	45	41	11	51	21	17	39	61	57	9	31	27	49	X
	O	O	O	U	U	U	O	O	O	U	O	U	O	U	U	U	O	O	O	U	U	U

Fig. 1141 —Tables for the odd-numbered half-cycles.

40. $R_1 \longrightarrow L_1$: $2o - 2u - o - 4u - 2o - 2u$.
41. $L_1 \longrightarrow R_2$: $2o - u - 3o$.
42. $R_2 \longrightarrow L_1$: $2u - o - 3u$.
43. $L_1 \longrightarrow R_2$: $o - 2u - 2o$.
44. $R_2 \longrightarrow L_1$: $u - 2o - 3u$.
45. $L_1 \longrightarrow R_1$: $2o - 2u - 2o - 4u - 2o - 2u$.
46. $R_1 \longrightarrow L_2$: $2o - u - 3o$.
47. $L_2 \longrightarrow R_1$: $2u - o - 3u$.
48. $R_1 \longrightarrow L_2$: $o - 2u - 3o$.
49. $L_2 \longrightarrow R_1$: $u - 2o - 3u$.
50. $R_1 \longrightarrow L_1$: $2o - 2u - 2o - 2u - o - 3u - 2o - 2u$.
51. $L_1 \longrightarrow R_2$: $3o - u - 3o$.

52. $R_2 \longrightarrow L_1 : \ 3u - o - 3u$.
53. $L_1 \longrightarrow R_2 : \ 2o - 2u - 3o$.
54. $R_2 \longrightarrow L_1 : \ 3u - 2o - 3u$.
55. $L_1 \longrightarrow R_1 : \ 3o - 2u - 2o - 2u - o - 3u - 2o - 2u$.
56. $R_1 \longrightarrow L_2 : \ 3o - u - 3o$.
57. $L_2 \longrightarrow R_1 : \ 3u - o - 3u$.
58. $R_1 \longrightarrow L_2 : \ 3o - 2u - 3o$.
59. $L_2 \longrightarrow R_1 : \ 3u - 2o - 3u$.

HALF-CYCLE									
2	24	46	42	64	16	12	34	56	52
12	34	56	52	4	26	22	44	66	62
22	44	66	62	14	36	32	54	6	2
32	54	6	2	24	46	42	64	16	12
42	64	16	12	34	56	52	4	26	22
52	4	26	22	44	66	62	14	36	32
62	14	36	32	54	6	2	24	46	42
	U	U	U	0	0	0	U	U	U

HALF-CYCLE									
4	26	22	44	66	62	14	36	32	54
14	36	32	54	6	2	24	46	42	64
24	46	42	64	16	12	34	56	52	4
34	56	52	4	26	22	44	66	62	14
44	66	62	14	36	32	54	6	2	24
54	6	2	24	46	42	64	16	12	34
64	16	12	34	56	52	4	26	22	44
	U	U	U	0	0	0	U	U	U

HALF-CYCLE									
6	28	50	46	68	20	16	38	60	56
16	38	60	56	8	30	26	48	70	66
26	48	70	66	18	40	36	58	10	6
36	58	10	6	28	50	46	68	20	16
46	68	20	16	38	60	56	8	30	26
56	8	30	26	48	70	66	18	40	36
66	18	40	36	58	10	6	28	50	46
	0	0	0	U	U	U	0	0	0

HALF-CYCLE									
8	30	26	48	70	66	18	40	36	58
18	40	36	58	10	6	28	50	46	68
28	50	46	68	20	16	38	60	56	8
38	60	56	8	30	26	48	70	66	18
48	70	66	18	40	36	58	10	6	28
58	10	6	28	50	46	68	20	16	38
68	20	16	38	60	56	8	30	26	48
	0	0	0	U	U	U	0	0	0

HALF-CYCLE																						
10	6	28	50	46	68	20	16	38	60	56	26	66	36	32	54	6	2	24	46	42	64	16
20	16	38	60	56	8	30	26	48	70	66	36	6	46	42	64	16	12	34	56	52	4	26
30	26	48	70	66	18	40	36	58	10	6	46	16	56	52	4	26	22	44	66	62	14	36
40	36	58	10	6	28	50	46	68	20	16	56	26	66	62	14	36	32	54	6	2	24	46
50	46	68	20	16	38	60	56	8	30	26	66	36	6	2	24	46	42	64	16	12	34	56
60	56	8	30	26	48	70	66	18	40	36	6	46	16	12	34	56	52	4	26	22	44	66
70	66	18	40	36	58	10	6	28	50	46	16	56	26	22	44	66	62	14	36	32	54	6
	0	0	0	U	U	U	0	0	0	U	0	U	0	U	U	U	0	0	0	U	U	U

Fig. 1142 —Tables for the even-numbered half-cycles.

60. $R_1 \longrightarrow L_1 : \ 3o - 2u - 2o - u - o - u - o - 3u - 3o - 2u$.
61. $L_1 \longrightarrow R_2 : \ 3o - 2u - 3o$.
62. $R_2 \longrightarrow L_1 : \ 3u - 3o - 3u$.
63. $L_1 \longrightarrow R_2 : \ 3o - 3u - 3o$.
64. $R_2 \longrightarrow L_1 : \ 3u - 3o - 3u$.
65. $L_1 \longrightarrow R_1 : \ 3o - 3u - 2o - u - o - u - o - 3u - 3o - 2u$.
66. $R_1 \longrightarrow L_2 : \ 3o - 3u - 3o$.
67. $L_2 \longrightarrow R_1 : \ 3u - 3o - 3u$.
68. $R_1 \longrightarrow L_2 : \ 3o - 3u - 3o$.

69. $L_2 \longrightarrow R_1$: $3u - 3o - 3u$.
70. $R_1 \longrightarrow L_1$: $3o - 3u - 3o - u - o - u - o - 3u - 3o - 3u$.

Knot 9.

The upper grid-diagram in Fig. 1143 depicts the foundation knot which is centrally interbraided with two Regular knots, each with $p/b = 7/6$. The first-return string-run of the foundation knot has been depicted in Fig. 1051, pg. 1309 of *The Braider*, Issue No. 55, with $C_1 = C_3 = 10$ and $C_2 = 15$. Hence $3C_1 + C_2 + 3C_3 = 30 + 15 + 30 = 75 = \beta'$ associated with circumferential bight-boundary L_1 and hence with $\alpha' = 3$. With $\alpha = 5$ and $\alpha' = 3$ we obtain $\beta = \dfrac{\beta' \cdot \alpha}{\alpha'} = \dfrac{75 \times 5}{3} = 125$, and consequently $\dfrac{\beta}{\alpha} = \dfrac{\beta'}{\alpha'} = \dfrac{125}{5} = \dfrac{75}{3} = 25$. For $\lambda = 1$, $\dfrac{{B_c}'}{\alpha'} = \dfrac{{B_c}'}{3}$ on bight-boundary L_1 must be coprime with 25. $\dfrac{{B_c}'}{3} = 6$ and hence ${B_c}' = 3 \times 6 = 18$ on bight-boundary L_1 fulfils this condition.

Note that this foundation knot has $B_c = 6 \times \alpha = 6 \times 5 = 30$ bights.

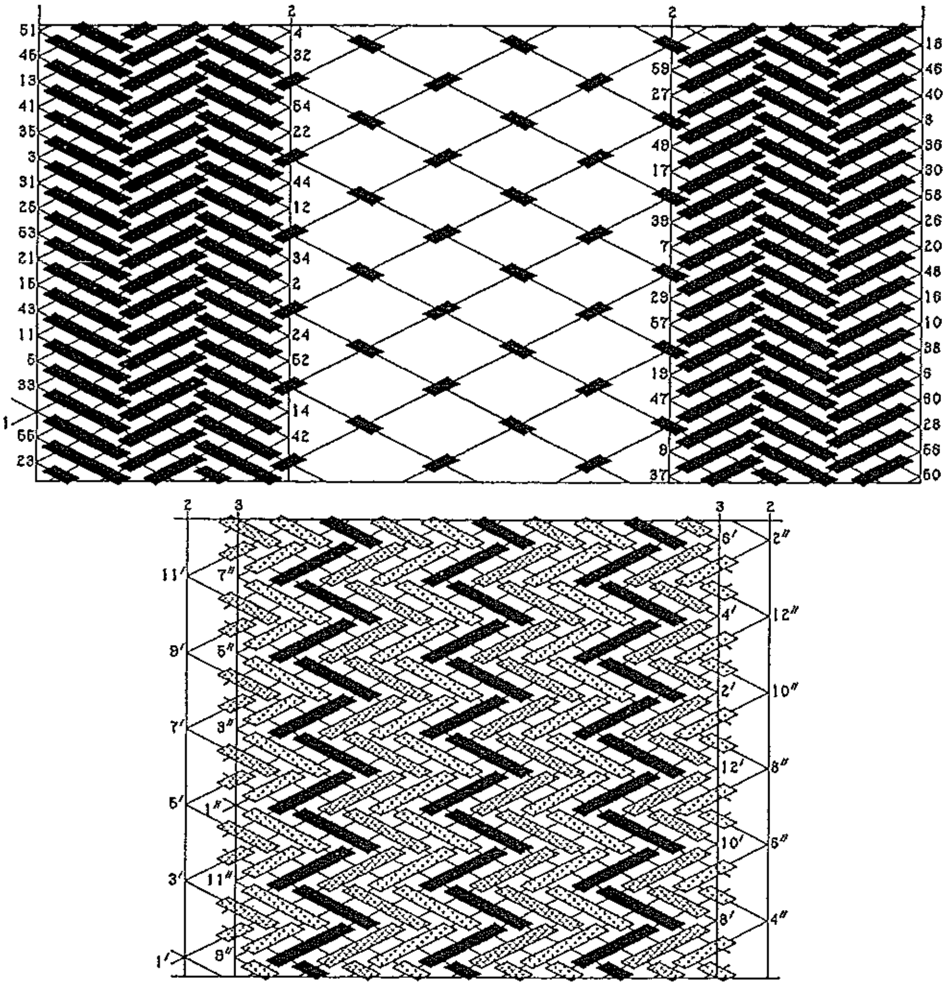

Fig. 1143 — Knot 9.

The half-cycle braiding algorithms for the foundation knot can be read from the tables in Fig. 1144 and Fig. 1145 as follows:

1. $L_1 \longrightarrow R_2$: Free run.
2. $R_2 \longrightarrow L_1$: Free run.

3. $L_1 \longrightarrow R_2$: Free run.
4. $R_2 \longrightarrow L_1$: o.
5. $L_1 \longrightarrow R_1$: u.
6. $R_1 \longrightarrow L_2$: Free run.
7. $L_2 \longrightarrow R_1$: Free run.
8. $R_1 \longrightarrow L_2$: u.
9. $L_2 \longrightarrow R_1$: o.

HALF-CYCLE									
1	33	5	11	43	15	21	53	25	31
11	43	15	21	53	25	31	3	35	41
21	53	25	31	3	35	41	13	45	51
31	3	35	41	13	45	51	23	55	X
41	13	45	51	23	55	X	33	5	11
51	23	55	X	33	5	11	43	15	21
	U	U	U	O	O	O	U	U	U

HALF-CYCLE									
3	35	41	13	45	51	23	55	X	33
13	45	51	23	55	X	33	5	11	43
23	55	X	33	5	11	43	15	21	53
33	5	11	43	15	21	53	25	31	3
43	15	21	53	25	31	3	35	41	13
53	25	31	3	35	41	13	45	51	23
	U	U	U	O	O	O	U	U	U

HALF-CYCLE									
7	39	11	17	49	21	27	59	31	37
17	49	21	27	59	31	37	9	41	47
27	59	31	37	9	41	47	19	51	57
37	9	41	47	19	51	57	29	X	7
47	19	51	57	29	X	7	39	11	17
57	29	X	7	39	11	17	49	21	27
	O	O	O	U	U	U	O	O	O

HALF-CYCLE									
9	41	47	19	51	57	29	X	7	39
19	51	57	29	X	7	39	11	17	49
29	X	7	39	11	17	49	21	27	59
39	11	17	49	21	27	59	31	37	9
49	21	27	59	31	37	9	41	47	19
59	31	37	9	41	47	19	51	57	29
	O	O	O	U	U	U	O	O	O

HALF-CYCLE																								
5	11	43	15	21	53	25	31	3	35	41	51	X	11	21	31	37	9	41	47	19	51	57	29	X
15	21	53	25	31	3	35	41	13	45	51	X	11	21	31	41	47	19	51	57	29	X	7	39	11
25	31	3	35	41	13	45	51	23	55	X	11	21	31	41	51	57	29	X	7	39	11	17	49	21
35	41	13	45	51	23	55	X	33	5	11	21	31	41	51	X	7	39	11	17	49	21	27	59	31
45	51	23	55	X	33	5	11	43	15	21	31	41	51	X	11	17	49	21	27	59	31	37	9	41
55	X	33	5	11	43	15	21	53	25	31	41	51	X	11	21	27	59	31	37	9	41	47	19	51
	U	U	U	O	O	O	U	U	U	O	U	O	U	O	U	O	O	O	U	U	U	O	O	O

Fig. 1144 —Tables for the odd-numbered half-cycles.

10. $R_1 \longrightarrow L_1$: $u - 3o$.
11. $L_1 \longrightarrow R_2$: u.
12. $R_2 \longrightarrow L_1$: o.
13. $L_1 \longrightarrow R_2$: $2u$.
14. $R_2 \longrightarrow L_1$: $u - 2o$.
15. $L_1 \longrightarrow R_1$: $o - u - 3o$.
16. $R_1 \longrightarrow L_2$: u.
17. $L_2 \longrightarrow R_1$: o.
18. $R_1 \longrightarrow L_2$: $o - 2u$.
19. $L_2 \longrightarrow R_1$: $u - 2o$.
20. $R_1 \longrightarrow L_1$: $o - 2u - o - 2u - 2o$.
21. $L_1 \longrightarrow R_2$: $o - u$.
22. $R_2 \longrightarrow L_1$: $u - o$.

23. $L_1 \longrightarrow R_2$: $2o - 2u$.
24. $R_2 \longrightarrow L_1$: $o - 2u - 2o$.
25. $L_1 \longrightarrow R_1$: $u - o - 2u - o - 2u - 2o$.
26. $R_1 \longrightarrow L_2$: $o - u$.
27. $L_2 \longrightarrow R_1$: $u - o$.
28. $R_1 \longrightarrow L_2$: $u - 2o - 2u$.
29. $L_2 \longrightarrow R_1$: $o - 2u - 2o$.

HALF-CYCLE									
2	34	6	12	44	16	22	54	26	32
12	44	16	22	54	26	32	4	36	42
22	54	26	32	4	36	42	14	46	52
32	4	36	42	14	46	52	24	56	2
42	14	46	52	24	56	2	34	6	12
52	24	56	2	34	6	12	44	16	22
	O	O	O	U	U	U	O	O	O

HALF-CYCLE									
4	36	42	14	46	52	24	56	2	34
14	46	52	24	56	2	34	6	12	44
24	56	2	34	6	12	44	16	22	54
34	6	12	44	16	22	54	26	32	4
44	16	22	54	26	32	4	36	42	14
54	26	32	4	36	42	14	46	52	24
	O	O	O	U	U	U	O	O	O

HALF-CYCLE									
6	38	10	16	48	20	26	58	30	36
16	48	20	26	58	30	36	8	40	46
26	58	30	36	8	40	46	18	50	56
36	8	40	46	18	50	56	28	60	6
46	18	50	56	28	60	6	38	10	16
56	28	60	6	38	10	16	48	20	26
	U	U	U	O	O	O	U	U	U

HALF-CYCLE									
8	40	46	18	50	56	28	60	6	38
18	50	56	28	60	6	38	10	16	48
28	60	6	38	10	16	48	20	26	58
38	10	16	48	20	26	58	30	36	8
48	20	26	58	30	36	8	40	46	18
58	30	36	8	40	46	18	50	56	28
	U	U	U	O	O	O	U	U	U

HALF-CYCLE																								
10	16	48	20	26	58	30	36	8	40	46	56	6	16	26	36	42	14	46	52	24	56	2	34	6
20	26	58	30	36	8	40	46	18	50	56	6	16	26	36	46	52	24	56	2	34	6	12	44	16
30	36	8	40	46	18	50	56	28	60	6	16	26	36	46	56	2	34	6	12	44	16	22	54	26
40	46	18	50	56	28	60	6	38	10	16	26	36	46	56	6	12	44	16	22	54	26	32	4	36
50	56	28	60	6	38	10	16	48	20	26	36	46	56	6	16	22	54	26	32	4	36	42	14	46
60	6	38	10	16	48	20	26	58	30	36	46	56	6	16	26	32	4	36	42	14	46	52	24	56
	U	U	U	O	O	O	U	U	U	O	U	O	U	O	U	O	O	O	U	U	U	O	O	O

Fig. 1145 —Tables for the even-numbered half-cycles.

30. $R_1 \longrightarrow L_1$: $u - o - u - o - u - 3o - 2u - 2o$.
31. $L_1 \longrightarrow R_2$: $u - o - u$.
32. $R_2 \longrightarrow L_1$: $o - u - 2o$.
33. $L_1 \longrightarrow R_2$: $2u - 2o - 3u$.
34. $R_2 \longrightarrow L_1$: $2o - 2u - 3o$.
35. $L_1 \longrightarrow R_1$: $u - o - 2u - o - u - 3o - 2u - 2o$.
36. $R_1 \longrightarrow L_2$: $u - o - 2u$.
37. $L_2 \longrightarrow R_1$: $o - u - 2o$.
38. $R_1 \longrightarrow L_2$: $2u - 2o - 3u$.
39. $L_2 \longrightarrow R_1$: $2o - 2u - 3o$.
40. $R_1 \longrightarrow L_1$: $u - o - 3u - o - u - o - u - 2o - 2u - 3o$.
41. $L_1 \longrightarrow R_2$: $u - o - 3u$.
42. $R_2 \longrightarrow L_1$: $o - 2u - 3o$.

43. $L_1 \longrightarrow R_2$: $2u - 3o - 3u$.
44. $R_2 \longrightarrow L_1$: $2o - 3u - 3o$.
45. $L_1 \longrightarrow R_1$: $u - 2o - 3u - o - u - o - u - 2o - 2u - 3o$.
46. $R_1 \longrightarrow L_2$: $u - 2o - 3u$.
47. $L_2 \longrightarrow R_1$: $o - 2u - 3o$.
48. $R_1 \longrightarrow L_2$: $2u - 3o - 3u$.
49. $L_2 \longrightarrow R_1$: $2o - 3u - 3o$.
50. $R_1 \longrightarrow L_1$: $u - 3o - 3u - o - u - 2o - u - 2o - 3u - 3o$.
51. $L_1 \longrightarrow R_2$: $u - 3o - 3u$.
52. $R_2 \longrightarrow L_1$: $2o - 3u - 3o$.
53. $L_1 \longrightarrow R_2$: $3u - 3o - 3u$.
54. $R_2 \longrightarrow L_1$: $3o - 3u - 3o$.
55. $L_1 \longrightarrow R_1$: $2u - 3o - 3u - o - u - 2o - u - 2o - 3u - 3o$.
56. $R_1 \longrightarrow L_2$: $2u - 3o - 3u$.
57. $L_2 \longrightarrow R_1$: $2o - 3u - 3o$.
58. $R_1 \longrightarrow L_2$: $3u - 3o - 3u$.
59. $L_2 \longrightarrow R_1$: $3o - 3u - 3o$.
60. $R_1 \longrightarrow L_1$: $3u - 3o - 3u - o - u - o - u - o - u - 3o - 3u - 3o$.

The half-cycle braiding algorithms for the half-cycles $1'$–$12'$ of the interbraided Regular Knot $p'/b = 7/6$ can be read from the upper algorithm diagram in Fig. 1146 and are as follows:

$1'$. : $o - u - o - u - o - u - o$.
$2'$. $(i = 0)$: $o - u - o - u - o - u - (s,1)2o$.
$3'$. $(i = 0)$: $o - u - o - u - o - u - 2o$.
$4'$. $(i \leq 1)$: $o - u - o - u - o - (s,1)2u - 2o$.
$5'$. $(i \leq 1)$: $o - u - o - u - o - 2u - 2o$.
$6'$. $(i \leq 2)$: $o - u - o - u - (s,1)2o - 2u - 2o$.
$7'$. $(i \leq 2)$: $o - u - o - u - 2o - 2u - 2o$.
$8'$. $(i \leq 3)$: $o - u - o - (s,1)2u - 2o - 2u - 2o$.
$9'$. $(i \leq 3)$: $o - u - o - 2u - 2o - 2u - 2o$.
$10'$. $(i \leq 4)$: $o - u - (s,1)2o - 2u - 2o - 2u - 2o$.
$11'$. $(i \leq 4)$: $o - u - 2o - 2u - 2o - 2u - 2o$.
$12'$. $(i \leq 5)$: $o - (s,1)2u - 2o - 2u - 2o - 2u - 2o$.

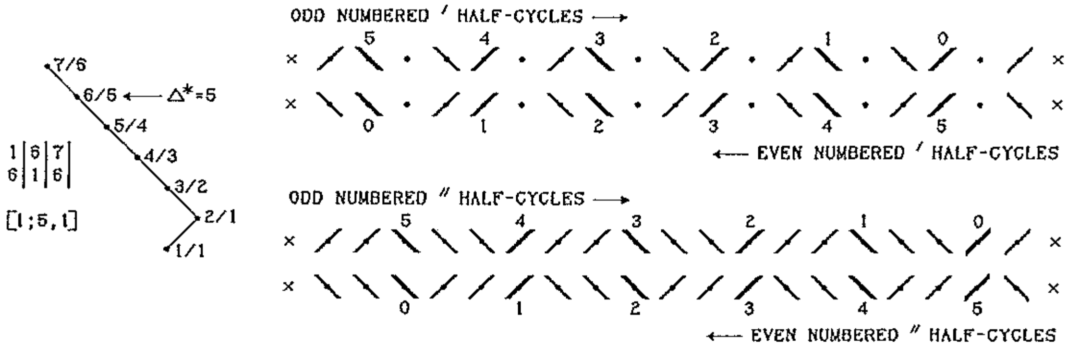
7/6
6/5 ← Δ*=5
5/4
4/3
3/2
2/1
1/1
1 6 7
6 1 6
[1;5,1]
ODD NUMBERED ′ HALF-CYCLES →
5 4 3 2 1 0
0 1 2 3 4 5
← EVEN NUMBERED ′ HALF-CYCLES
ODD NUMBERED ″ HALF-CYCLES →
5 4 3 2 1 0
0 1 2 3 4 5
← EVEN NUMBERED ″ HALF-CYCLES

Fig. 1146 — The interbraided $p'/b = 7/6$ and $p''/b = 7/6$ Regular Knots.

The half-cycle braiding algorithms for the half-cycles $1''$–$12''$ of the interbraided Regular Knot $p''/b = 7/6$ can be read from the lower algorithm diagram in Fig. 1146 and are as follows:

$1''$. : $2o - 2u - 2o - 2u - 2o - 2u - o$.

$2''.$ $(i = 0)$: $o - 2u - 2o - 2u - 2o - 2u - (s,2)3o\,.$
$3''.$ $(i = 0)$: $2o - 2u - 2o - 2u - 2o - 2u - 2o\,.$
$4''.$ $(i \leq 1)$: $o - 2u - 2o - 2u - 2o - (s,2)3u - 3o\,.$
$5''.$ $(i \leq 1)$: $2o - 2u - 2o - 2u - 2o - 3u - 2o\,.$
$6''.$ $(i \leq 2)$: $o - 2u - 2o - 2u - (s,2)3o - 3u - 3o\,.$
$7''.$ $(i \leq 2)$: $2o - 2u - 2o - 2u - 3o - 3u - 2o\,.$
$8''.$ $(i \leq 3)$: $o - 2u - 2o - (s,2)3u - 3o - 3u - 3o\,.$
$9''.$ $(i \leq 3)$: $2o - 2u - 2o - 3u - 3o - 3u - 2o\,.$
$10''.$ $(i \leq 4)$: $o - 2u - (s,2)3o - 3u - 3o - 3u - 3o\,.$
$11''.$ $(i \leq 4)$: $2o - 2u - 3o - 3u - 3o - 3u - 2o\,.$
$12''.$ $(i \leq 5)$: $o - (s,2)3u - 3o - 3u - 3o - 3u - 3o\,.$

In Fig. 1147 the braid of the foundation knot starts at the centre of its string-length.

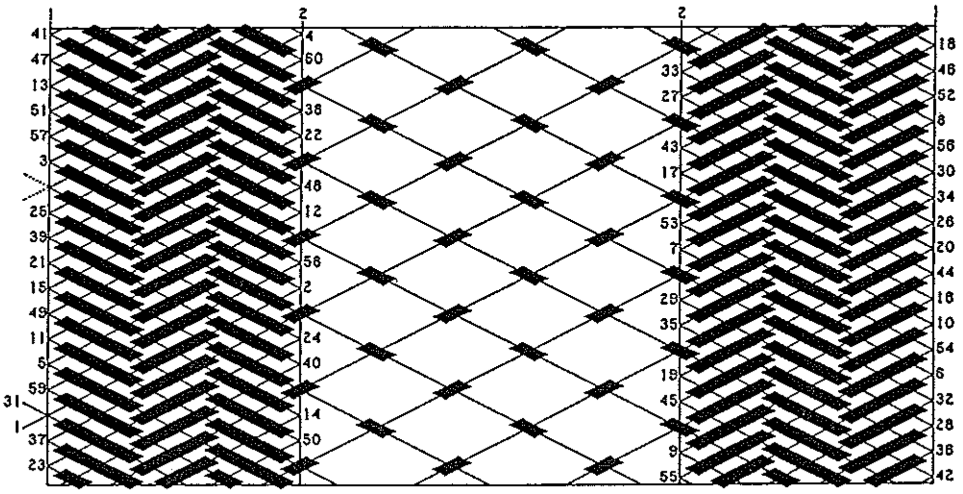

Fig. 1147 — Starting the foundation knot braid at the centre of its string-length.

The half-cycle braiding algorithms for the half-cycles 1–30 of the foundation knot can be read as before from the tables in Fig. 1144 and Fig. 1145. The half-cycle braiding algorithms for the half-cycles 31–60 of the foundation knot can be read from the tables in Fig. 1148 and Fig. 1149 and are as follows:[†]

31. $L_1 \longrightarrow R_1$: $o - u - o - u - o - 3u - 2o - 2u\,.$
32. $R_1 \longrightarrow L_2$: $o - u - 2o\,.$
33. $L_2 \longrightarrow R_1$: $u - o - 2u\,.$
34. $R_1 \longrightarrow L_2$: $2o - 2u - 3o\,.$
35. $L_2 \longrightarrow R_1$: $2u - 2o - 3u\,.$
36. $R_1 \longrightarrow L_1$: $o - u - 3o - u - o - u - o - 2u - 2o - 2u\,.$
37. $L_1 \longrightarrow R_2$: $o - u - 2o\,.$
38. $R_2 \longrightarrow L_1$: $u - o - 3u\,.$
39. $L_1 \longrightarrow R_2$: $2o - 2u - 3o\,.$
40. $R_2 \longrightarrow L_1$: $2u - 2o - 3u\,.$

[†] The numerical entries y in the tables of Figs. 1148 & 1149 are obtained from the numerical entries x in the tables of Figs. 1144 & 1145 with the relationship $y = |x - 4|_{60}$ since half-cycle 31 in Fig. 1147 occupies a similar position as half-cycle 35 in Fig. 1143. The tables in Figs. 1148 & 1149 belong to the complete string-run which starts at the end of half-cycle 30 in Fig. 1143, running from upper left bight-boundary to lower right bight-boundary.

41. $L_1 \longrightarrow R_1$: $o - u - 3o - u - o - u - o - 2u - 2o - 3u$.
42. $R_1 \longrightarrow L_2$: $o - 2u - 3o$.
43. $L_2 \longrightarrow R_1$: $u - 2o - 3u$.
44. $R_1 \longrightarrow L_2$: $2o - 3u - 3o$.

HALF-CYCLE									
3	35	7	13	45	17	23	55	27	33
13	45	17	23	55	27	33	5	37	43
23	55	27	33	5	37	43	15	47	53
33	5	37	43	15	47	53	25	57	3
43	15	47	53	25	57	3	35	7	13
53	25	57	3	35	7	13	45	17	23
	U	U	U	O	O	O	U	U	U

HALF-CYCLE									
5	37	43	15	47	53	25	57	3	35
15	47	53	25	57	3	35	7	13	45
25	57	3	35	7	13	45	17	23	55
35	7	13	45	17	23	55	27	33	5
45	17	23	55	27	33	5	37	43	15
55	27	33	5	37	43	15	47	53	25
	U	U	U	O	O	O	U	U	U

HALF-CYCLE									
7	39	11	17	49	21	27	59	31	37
17	49	21	27	59	31	37	9	41	47
27	59	31	37	9	41	47	19	51	57
37	9	41	47	19	51	57	29	~~1~~	7
47	19	51	57	29	~~1~~	7	39	11	17
57	29	~~1~~	7	39	11	17	49	21	27
	O	O	O	U	U	U	O	O	O

HALF-CYCLE									
9	41	47	19	51	57	29	~~1~~	7	39
19	51	57	29	~~1~~	7	39	11	17	49
29	~~1~~	7	39	11	17	49	21	27	59
39	11	17	49	21	27	59	31	37	9
49	21	27	59	31	37	9	41	47	19
59	31	37	9	41	47	19	51	57	29
	O	O	O	U	U	U	O	O	O

HALF-CYCLE																								
1	7	39	11	17	49	21	27	59	31	37	47	57	7	17	27	33	5	37	43	15	47	53	25	57
11	17	49	21	27	59	31	37	9	41	47	57	7	17	27	37	43	15	47	53	25	57	3	35	7
21	27	59	31	37	9	41	47	19	51	57	7	17	27	37	47	53	25	57	3	35	7	13	45	17
31	37	9	41	47	19	51	57	29	~~1~~	7	17	27	37	47	57	3	35	7	13	45	17	23	55	27
41	47	19	51	57	29	~~1~~	7	39	15	17	27	37	47	57	7	13	45	17	23	55	27	33	5	37
51	57	29	~~1~~	7	39	11	17	49	25	27	37	47	57	7	17	23	55	27	33	5	37	43	15	47
	O	O	O	U	U	U	O	O	O	U	O	U	O	U	O	U	U	U	O	O	O	U	U	U

Fig. 1148 —Tables for the odd-numbered half-cycles.

45. $L_2 \longrightarrow R_1$: $2u - 3o - 3u$.
46. $R_1 \longrightarrow L_1$: $o - 3u - 3o - u - o - 2u - o - 2u - 2o - 3u$.
47. $L_1 \longrightarrow R_2$: $o - 2u - 3o$.
48. $R_2 \longrightarrow L_1$: $u - 3o - 3u$.
49. $L_1 \longrightarrow R_2$: $2o - 3u - 3o$.
50. $R_2 \longrightarrow L_1$: $2u - 3o - 3u$.
51. $L_1 \longrightarrow R_1$: $o - 3u - 3o - u - o - 2u - o - 2u - 3o - 3u$.
52. $R_1 \longrightarrow L_2$: $2o - 3u - 3o$.
53. $L_2 \longrightarrow R_1$: $2u - 3o - 3u$.
54. $R_1 \longrightarrow L_2$: $3o - 3u - 3o$.
55. $L_2 \longrightarrow R_1$: $3u - 3o - 3u$.
56. $R_1 \longrightarrow L_1$: $3o - 3u - 3o - u - o - u - o - u - o - 2u - 3o - 3u$.
57. $L_1 \longrightarrow R_2$: $2o - 3u - 3o$.
58. $R_2 \longrightarrow L_1$: $3u - 3o - 3u$.
59. $L_1 \longrightarrow R_2$: $3o - 3u - 3o$.
60. $R_2 \longrightarrow L_1$: $3u - 3o - 3u$.

HALF-CYCLE									
2	34	6	12	44	16	22	54	26	32
12	44	16	22	54	26	32	4	36	42
22	54	26	32	4	36	42	14	46	52
32	4	36	42	14	46	52	24	56	2
42	14	46	52	24	56	2	34	6	12
52	24	56	2	34	6	12	44	16	22
	0	0	0	U	U	U	0	0	0

HALF-CYCLE									
4	36	42	14	46	52	24	56	2	34
14	46	52	24	56	2	34	6	12	44
24	56	2	34	6	12	44	16	22	54
34	6	12	44	16	22	54	26	32	4
44	16	22	54	26	32	4	36	42	14
54	26	32	4	36	42	14	46	52	24
	0	0	0	U	U	U	0	0	0

HALF-CYCLE									
8	40	12	18	50	22	28	60	32	38
18	50	22	28	60	32	38	10	42	48
28	60	32	38	10	42	48	20	52	58
38	10	42	48	20	52	58	30	2	8
48	20	52	58	30	2	8	40	12	18
58	30	2	8	40	12	18	50	22	28
	U	U	U	0	0	0	U	U	U

HALF-CYCLE									
10	42	48	20	52	58	30	2	8	40
20	52	58	30	2	8	40	12	18	50
30	2	8	40	12	18	50	22	28	60
40	12	18	50	22	28	60	32	38	10
50	22	28	60	32	38	10	42	48	20
60	32	38	10	42	48	20	52	58	30
	U	U	U	0	0	0	U	U	U

HALF-CYCLE																								
6	12	44	16	22	54	26	32	4	36	42	52	2	12	22	32	38	10	42	48	20	52	58	30	2
16	22	54	26	32	4	36	42	14	46	52	2	12	22	32	42	48	20	52	58	30	2	8	40	12
26	32	4	36	42	14	46	52	24	56	2	12	22	32	42	52	58	30	2	8	40	12	18	50	22
36	42	14	46	52	24	56	2	34	6	12	22	32	42	52	2	8	40	12	18	50	22	28	60	32
46	52	24	56	2	34	6	12	44	16	22	32	42	52	2	12	18	50	22	28	60	32	38	10	42
56	2	34	6	12	44	16	22	54	26	32	42	52	2	12	22	28	60	32	38	10	42	48	20	52
	0	0	0	U	U	U	0	0	0	U	0	U	0	U	0	U	U	U	0	0	0	U	U	U

Fig. 1149 —Tables for the even-numbered half-cycles.

Knot 10.

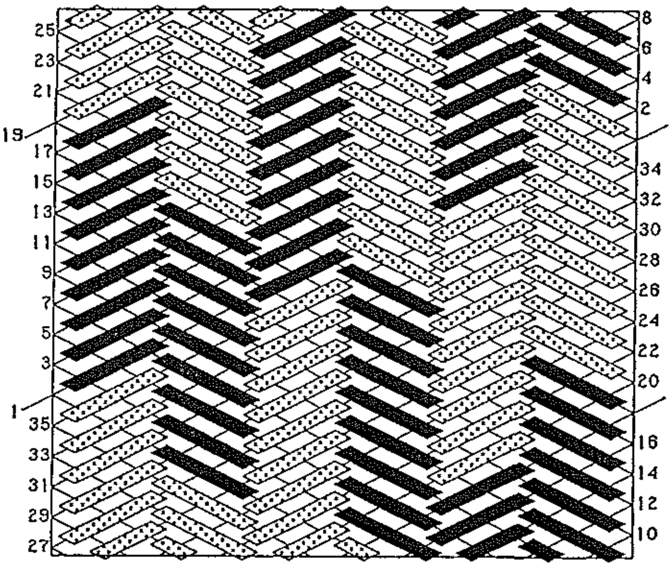

Fig. 1150 — Knot 10.

The string-run of this Regular Knot has $6 \times 3 = 18$ intersection columns and hence its overall string-run has $p = 18 + 1 = 19$ parts. Let the overall string-run have $b = p - 1 = 19 - 1 = 18$ bights. Although this knot can hence be braided from one string, we like to introduce, however, a colour-pattern in the braid and consequently we will have to use more than one string. A two colour pattern requires two strings of contrasting colour. For a balanced colour-pattern, each string has to build half the overall braid-pattern. This can be achieved by letting one coloured string form the half-cycles $1-17$ and the other coloured string form the half-cycles $19-35$; finally finishing the braid by braiding and working away the end of half-cycle 17 and the Standing End of half-cycle 19, respectively by braiding and working away the end of half-cycle 35 and the Standing End of half-cycle 19.

Fig. 1151 shows the path of $p/b = 19/18$ in the RKT and its algorithm diagram.

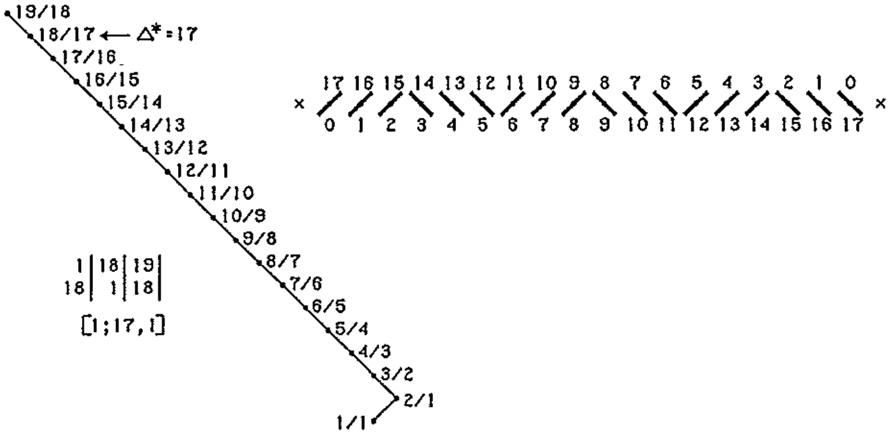

Fig. 1151 — Algorithm diagram of $p/b = 19/18$ and its path in the RKT.

The half-cycle braiding algorithms are read from the algorithm diagram in the usual manner, provided the following exceptions are observed:

i. The half-cycles 18 and 36 are not laid down.

ii. For the odd-numbered half-cycle h_o in the range $19-35$, the entry $i = \dfrac{h_o - 3}{2} - 8$ is neglected.[†]

Hence the half-cycle braiding algorithms are as follows:

1. : Free run.
2. $(i = 0)$: $(s)u$.
3. $(i = 0)$: u.
4. $(i \leq 1)$: $(s,1)2u$.
5. $(i \leq 1)$: $2u$.
6. $(i \leq 2)$: $(s,2)3u$.
7. $(i \leq 2)$: $3u$.
8. $(i \leq 3)$: $(s)o - 3u$.
9. $(i \leq 3)$: $o - 3u$.
10. $(i \leq 4)$: $(s,1)2o - 3u$.
11. $(i \leq 4)$: $2o - 3u$.
12. $(i \leq 5)$: $(s,2)3o - 3u$.

[†] Note that the subtraction of 8 is associated with half-cycle 18 which did not get laid down $\left(i = \dfrac{h_e - 2}{2} = \dfrac{18 - 2}{2} = 8\right)$.

13. $(i \le 5)$: $3o - 3u$.
14. $(i \le 6)$: $(s)u - 3o - 3u$.
15. $(i \le 6)$: $u - 3o - 3u$.
16. $(i \le 7)$: $(s,1)2u - 3o - 3u$.
17. $(i \le 7)$: $2u - 3o - 3u$.

19. $(i \le 8$, neglect $i = 0)$: $3u - 3o - 2u$.
20. $(i \le 9)$: $(s)o - 3u - 3o - (2, s^*)3u$.
21. $(i \le 9$, neglect $i = 1)$: $o - 3u - 3o - 2u$.
22. $(i \le 10)$: $(s,1)2o - 3u - 3o - (1, s^*, 1)3u$.
23. $(i \le 10$, neglect $i = 2)$: $2o - 3u - 3o - 2u$.
24. $(i \le 11)$: $(s,2)3o - 3u - 3o - (s^*, 2)3u$.
25. $(i \le 11$, neglect $i = 3)$: $3o - 3u - 2o - 3u$.
26. $(i \le 12)$: $(s)u - 3o - 3u - (2, s^*)3o - 3u$.
27. $(i \le 12$, neglect $i = 4)$: $u - 3o - 3u - 2o - 3u$.
28. $(i \le 13)$: $(s,1)2u - 3o - 3u - (1, s^*, 1)3o - 3u$.
29. $(i \le 13$, neglect $i = 5)$: $2u - 3o - 3u - 2o - 3u$.
30. $(i \le 14)$: $(s,2)3u - 3o - 3u - (s^*, 2)3o - 3u$.
31. $(i \le 14$, neglect $i = 6)$: $3u - 3o - 2u - 3o - 3u$.
32. $(i \le 15)$: $(s)o - 3u - 3o - (2, s^*)3u - 3o - 3u$.
33. $(i \le 15$, neglect $i = 7)$: $o - 3u - 3o - 2u - 3o - 3u$.
34. $(i \le 16)$: $(s,1)2o - 3u - 3o - (1, s^*, 1)3u - 3o - 3u$.
35. $(i \le 16$, neglect $i = 8)$: $2o - 3u - 3o - 2u - 3o - 3u$.

Knot 11.

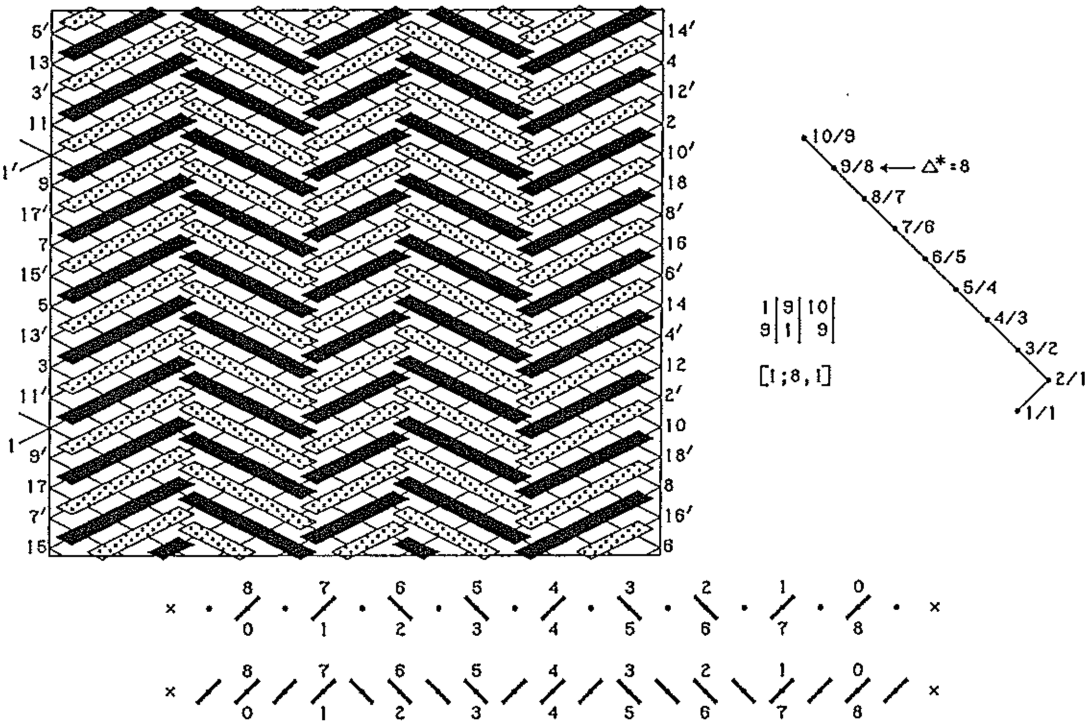

Fig. 1152 — Knot 11.

Upper algorithm diagram for the first to be braided component (half-cycles 1 – 18); lower algorithm diagram for the second to be braided component (half-cycles 1′ – 18′).

THE BRAIDER

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for
the braiding artisan

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THE BRAIDER'S NOTEBOOK

Since braiding is still in the infant stage of development, it is not surprising that one can often encounter knots which have a seemingly good braided pattern. However, a closer inspection will reveal an unbalance in the design. Such unbalanced, but seemingly good patterns are commonly encountered in braid-work produced by pattern-braiders. In general, pattern-braiders don't use grid-diagrams in the design stage, which is an essential preliminary requirement in good braid design. We shall discuss here a few examples of braids which seemingly appear to have a good pattern, but which in fact are unbalanced, and show how with a small modification a good balanced pattern can be created.

A commonly encountered colour-pattern in Regular Knots is shown in the left-hand grid-diagrams of Fig. 1153. The coding-pattern is unbalanced and should in general be avoided.

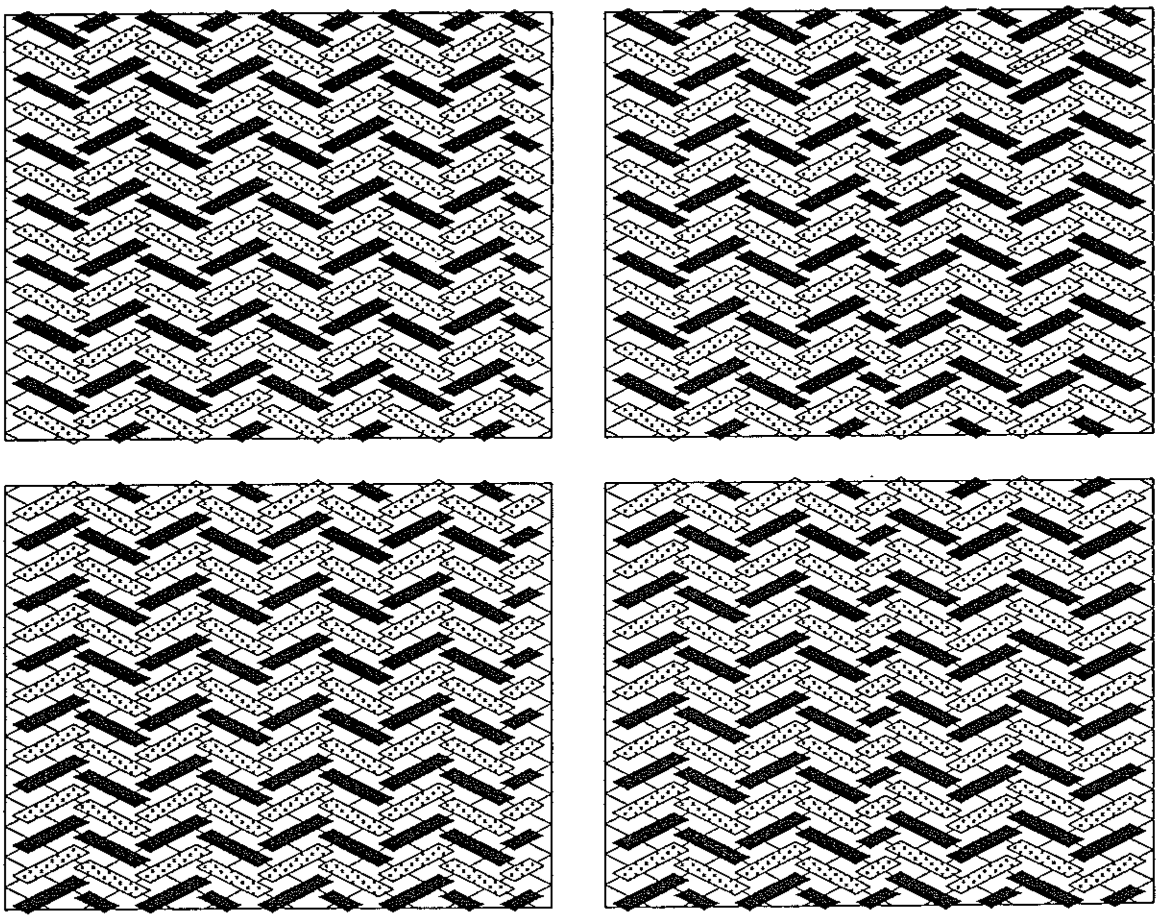


Fig. 1153.

For such a colour-pattern the g.c.d. (p, b) has to be equal to 2, hence a true two-pass coding-pattern cannot give us such a colour-pattern since in that case $p = 2n+1 = odd$. A balanced pattern (as for example shown in the right-hand grid-diagrams of Fig. 1153) can only be obtained when $p = 4n + 2$.

The coding-pattern in the left-hand grid-diagrams of Fig. 1154 is again unbalanced and although in the finished knot the pattern seems to be a good one, it should in general be avoided. A balanced pattern (as for example shown in the right-hand grid-diagrams of Fig. 1154) can only be obtained when $p = 8n + 4$.

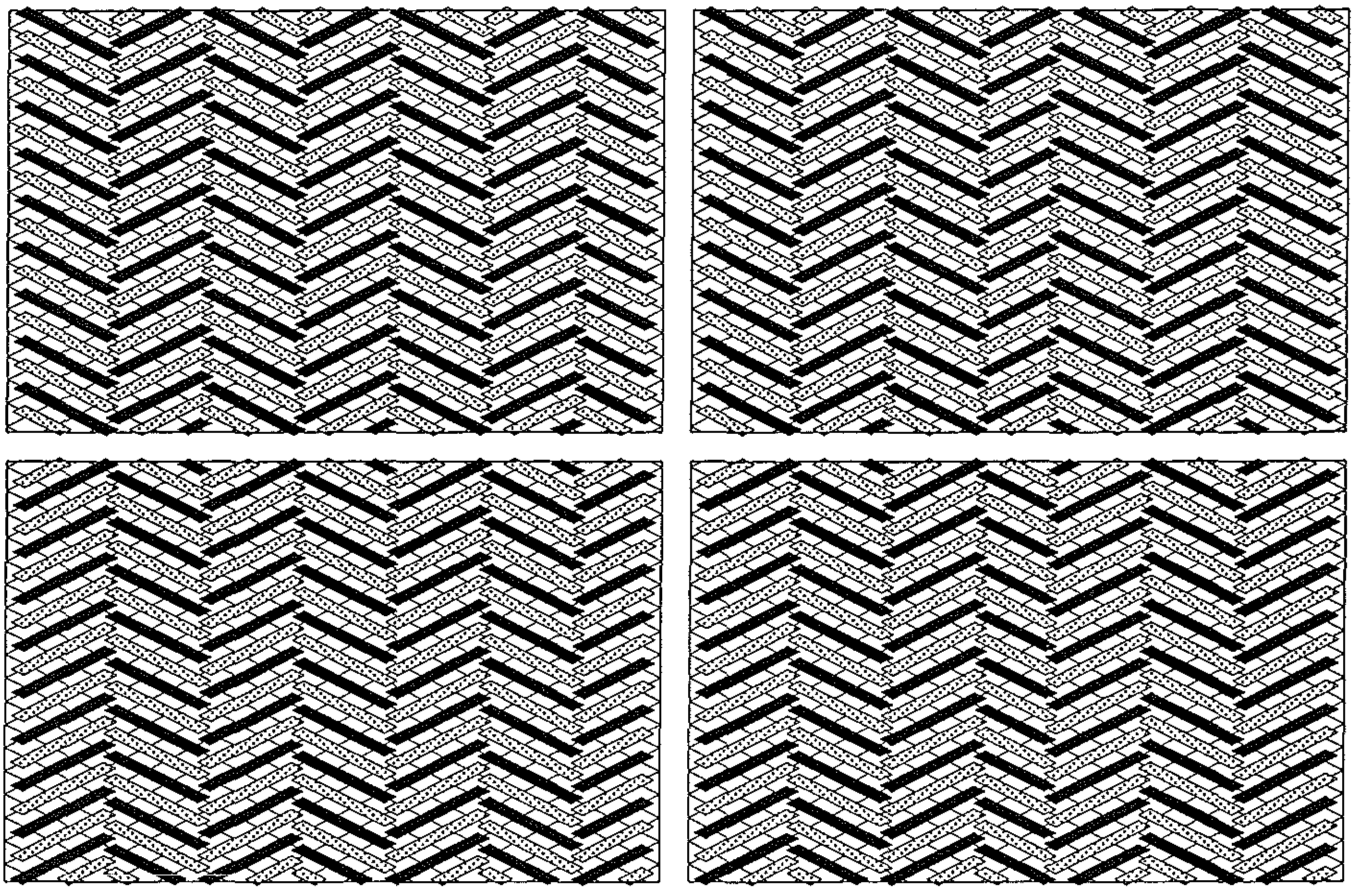


Fig. 1154.

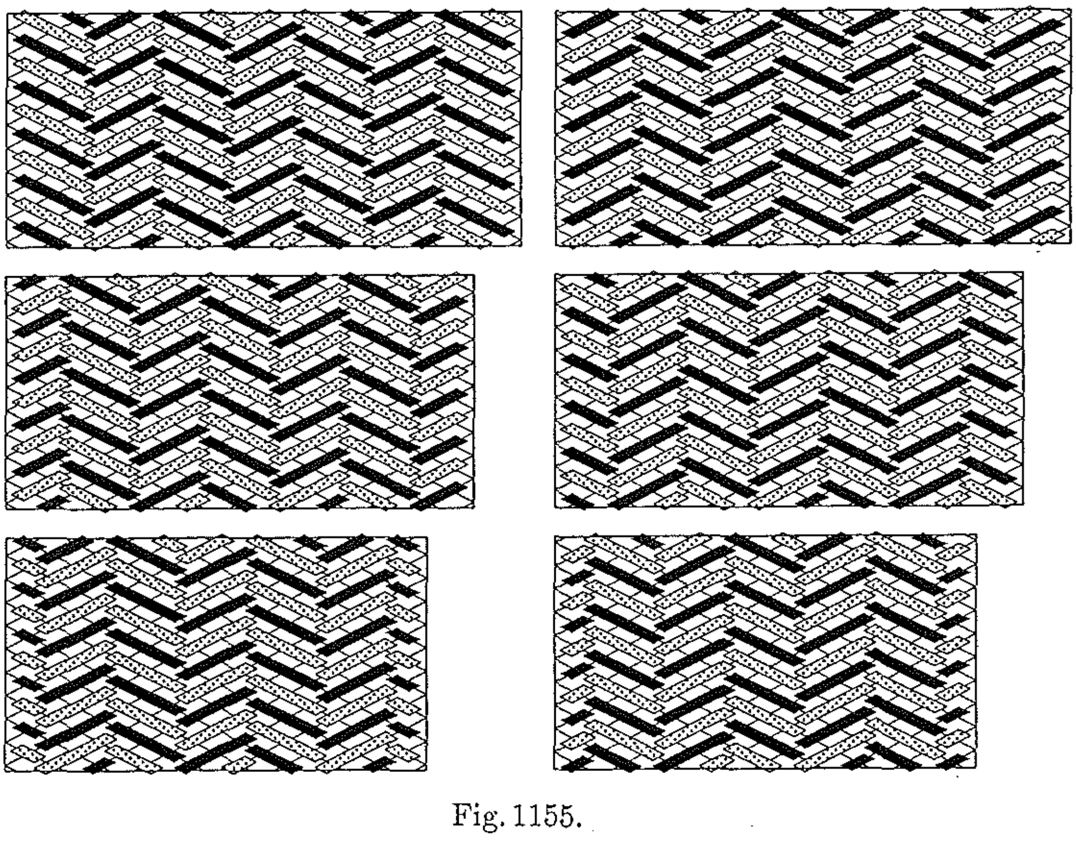


Fig. 1155.

The patterns in the grid-diagrams of Fig. 1155 form helixes and are all balanced. Again the g.c.d.(p, b) has to be equal to 2. For the pattern in the uppermost two grid-diagrams, $p = 3n + 1$ and hence n has to be *odd*. For the pattern in the central two grid-diagrams, $p = 3n + 5$ and hence n has to be *odd*. For the pattern in the lowermost two grid-diagrams, $p = 3n + 3$ and hence n has to be *odd*. Ensure that left and right helix angle of the string-run are the same.

A very common pattern-braider's knot is a column-coded α-pass column-coded Regular Knot (hence $p = \alpha m + 1$) where $b = p - 1 = \alpha m$. Hence p and b are coprime and although such a knot can be braided from a single string, it is not surprising that it may be encountered in a two colour braid-pattern where $\left\lfloor \frac{b}{2} \right\rfloor$ adjacent bights are of one colour and $\left\lceil \frac{b}{2} \right\rceil$ adjacent bights are of another colour.† These two bight numbers are then the same when $\alpha m = even$ and differ by 1 when both α and m are *odd*. When both α and m are *odd*, such two-colour knots may indicate the skill-level of the braider involved. A skilled braider would ensure that the pattern in the knot is balanced and would have been aided by the grid-diagram before starting the braiding process. A braider who does not possess a sufficient skill-level may for example produce the knot depicted by the left-hand grid-diagram in Fig. 1156.

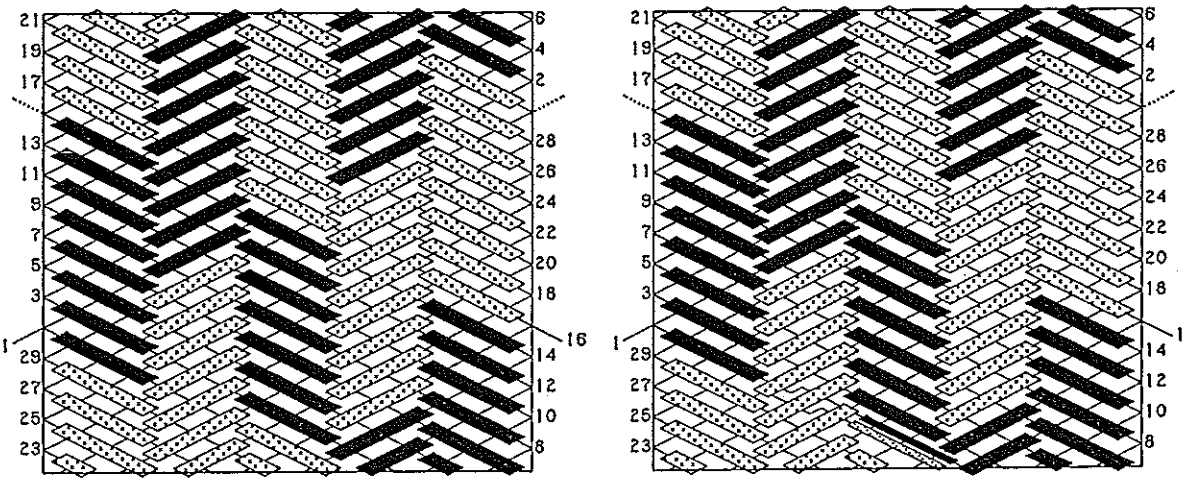


Fig. 1156.

The pattern of this knot is unbalanced (compare the circled areas in Fig. 1157). We have come across this knot in 2 mm. round string where the braider had tried to rectify the unbalance (see the right-hand grid-diagram in Fig. 1156). The pattern in the actual finished knot may then seem to be balanced since the local string-run irregularity created may not be obvious, but will nevertheless be revealed by a closer examination. Instead of braiding the two strings as indicated in the left-hand grid-diagram of Fig. 1156, where one string first braids the half-cycles 1–14 and the other string then braids the half-cycles 16–29 followed by working away the Standing End of half-cycle 1 with the string-end of half-cycle 29 and the string-end of half-cycle 14 with the Standing End of half-cycle 16, we can braid the two strings as indicated in the grid-diagram of Fig. 1158, where one string first braids the half-cycles 1–15 and the other string then braids the half-cycles 17–29 followed by working away the Standing End of half-cycle 1 with the string-end of half-cycle 29 and the string-end of half-cycle 15 with the Standing End of half-cycle 17. This creates the balanced pattern shown in the grid-diagram of Fig. 1158.

---

† $\left\lfloor \frac{b}{2} \right\rfloor$ denotes the greatest whole number equal to or smaller than $\frac{b}{2}$.

$\left\lceil \frac{b}{2} \right\rceil$ denotes the smallest whole number equal to or greater than $\frac{b}{2}$.

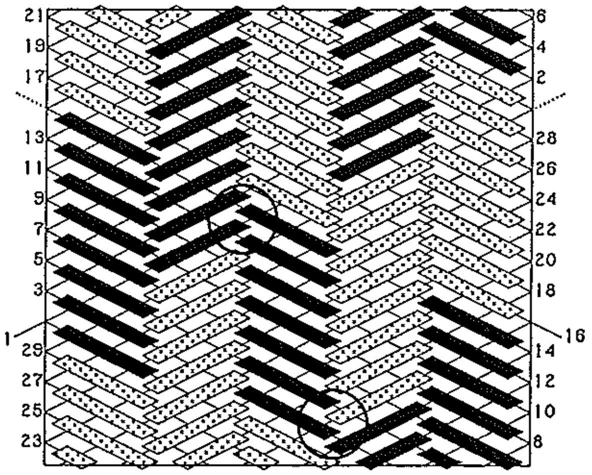


Fig. 1157.

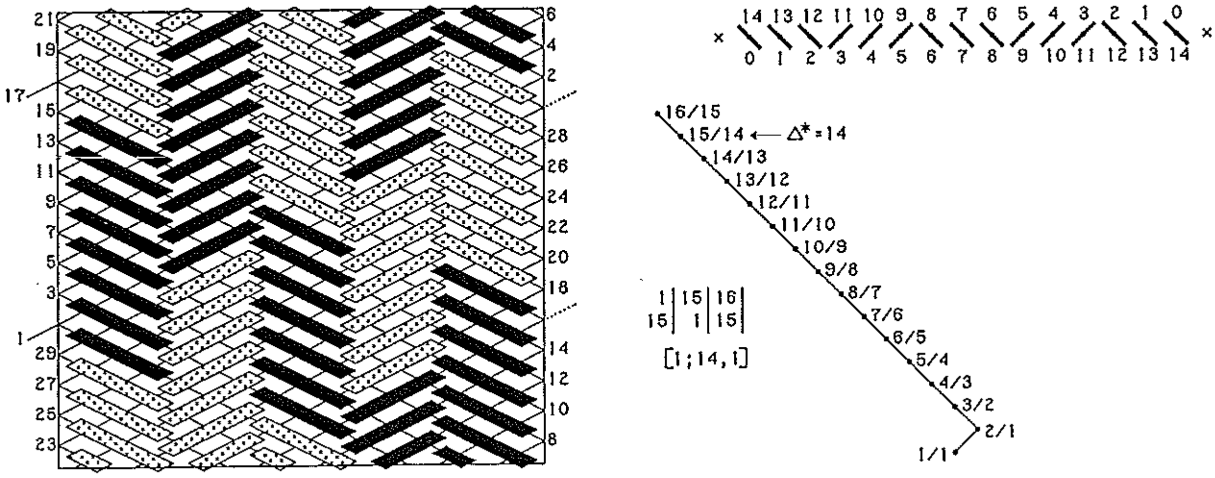


Fig. 1158.

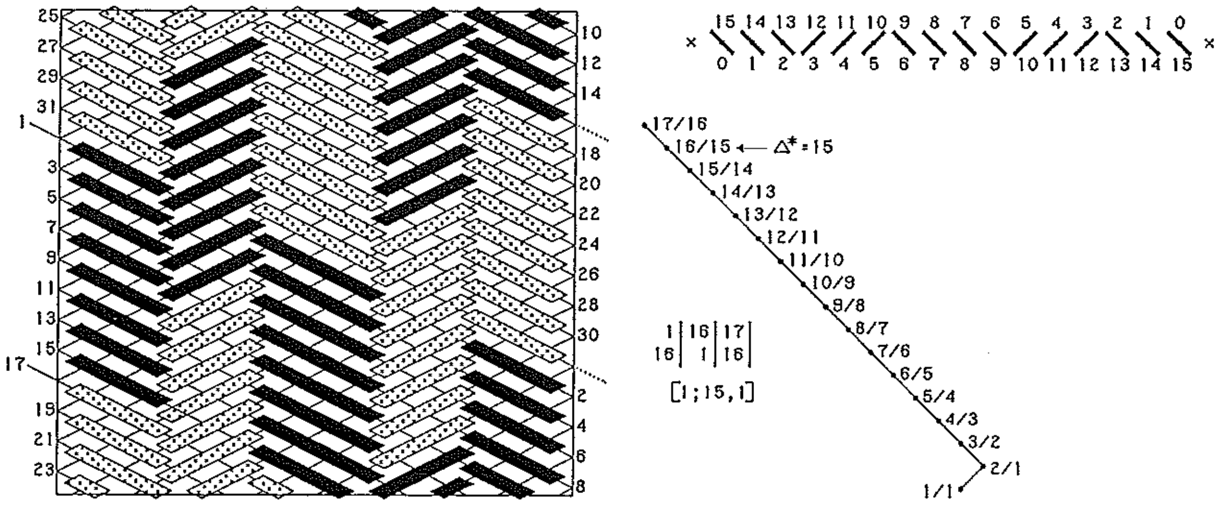


Fig. 1159.

Replacing the central three intersection-columns by four intersection columns gives $p = 17$ and $b = 16$ for $b = p - 1$, and by changing the central three-pass column-coding into a four-pass column-coding, we obtain the grid-diagram in Fig. 1159 with a balanced pattern. First we braid with one of the two strings the half-cycles 1–15, then with the other string we braid the half-cycles 17–31 followed by working away the Standing End of half-cycle 1 with the string-end of half-cycle 31 and the string-end of half-cycle 15 with the Standing End of half-cycle 17.

The Saturn Knots

Saturn Knots are formed by the incorporation of two knot-forms where one forms a collar around the other. The collar forming knot-form is a multi-pointed Star Knot of the type described by P. P. O. Harrison as No. 15 on pp. 6 and 7 in the Harrison Book of Knots. Let's call such a Star Knot the Standard Star Knot. There he describes with the aid of Fig. 1160 the Standard Star Knot with five points as follows:

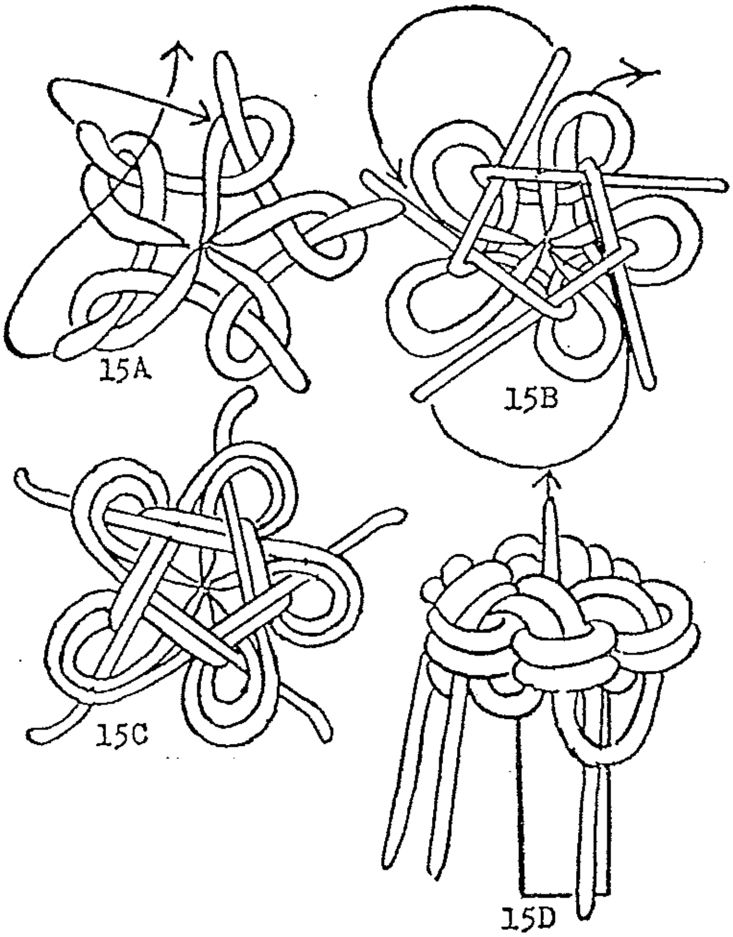


Fig. 1160 — The five pointed Standard Star Knot in the Harrison Book of Knots.

Grasp the stem in the left hand. Commence by forming a Half Hitch with each strand and passing the end of the strand through the loop of the next Half Hitch to the right. Work the Half Hitches up snugly to the centre (Figure 15A). Form a Left-hand Crown with all the strands. Figure 15B shows the completed Left-hand Crown.

Tuck each strand back above the loop of the Half Hitch and under its own part. With each strand in turn follow the lead inside the adjoining strand to the right, over one Half Hitch, and down through the loop of the next Half Hitch. Figure 15C shows the knot at this stage, and Figure 15D shows another view of it. Continue to follow the lead underneath the knot and tuck each strand in turn up through the centre. (Figure 15D).[†]

A better understanding of the string-run of the Standard Star Knot is obtained from its layout as presented in Fig. 1161 (upper diagram depicts the five pointed Standard Star Knot and the lower diagram depicts the eight pointed Standard Star Knot).

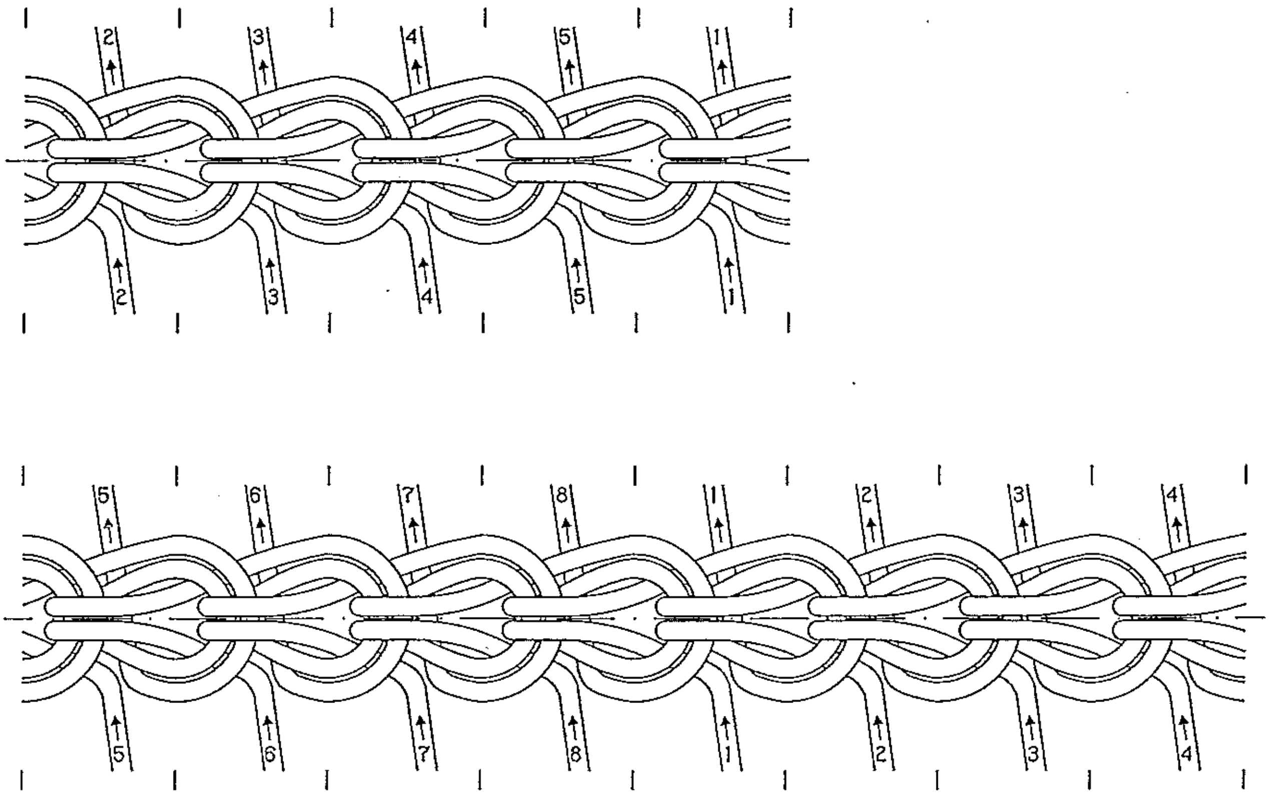


Fig. 1161 — The five and the eight pointed Standard Star Knot.

The string-run clearly shows that an n pointed Standard Star Knot requires n strings.

Replacing the exit-loop of string $|a+1|_n$ by string a and joining it to the entry of string $|a+1|_n$, where $1 \leq a \leq n$, leads to the single string n pointed Star Knot (the n pointed Perfect Star Knot). In Fig. 1162 is shown this procedure for obtaining the five and the eight pointed Perfect Star Knots from the five and the eight pointed Standard Star Knots. Hence the string-run layout of the n pointed Standard Star Knot as depicted in Fig. 1161 leads automatically to the string-run of the n pointed single string Star Knot (the n pointed Perfect Star Knot) in Fig. 1162 and similarly the mirror-imaged string-run of the n pointed Standard Star Knot in Fig. 1161 leads automatically to the mirror-imaged string-run of the n pointed single string Star Knot in Fig. 1162.

[†] Note that in Harrison's book the right black arrowed line in Figure 15B contains an error which has been rectified here in Fig. 1160. Also note that this error in Harrison's book has been repeated there on pg. 36 in Figure 73B.

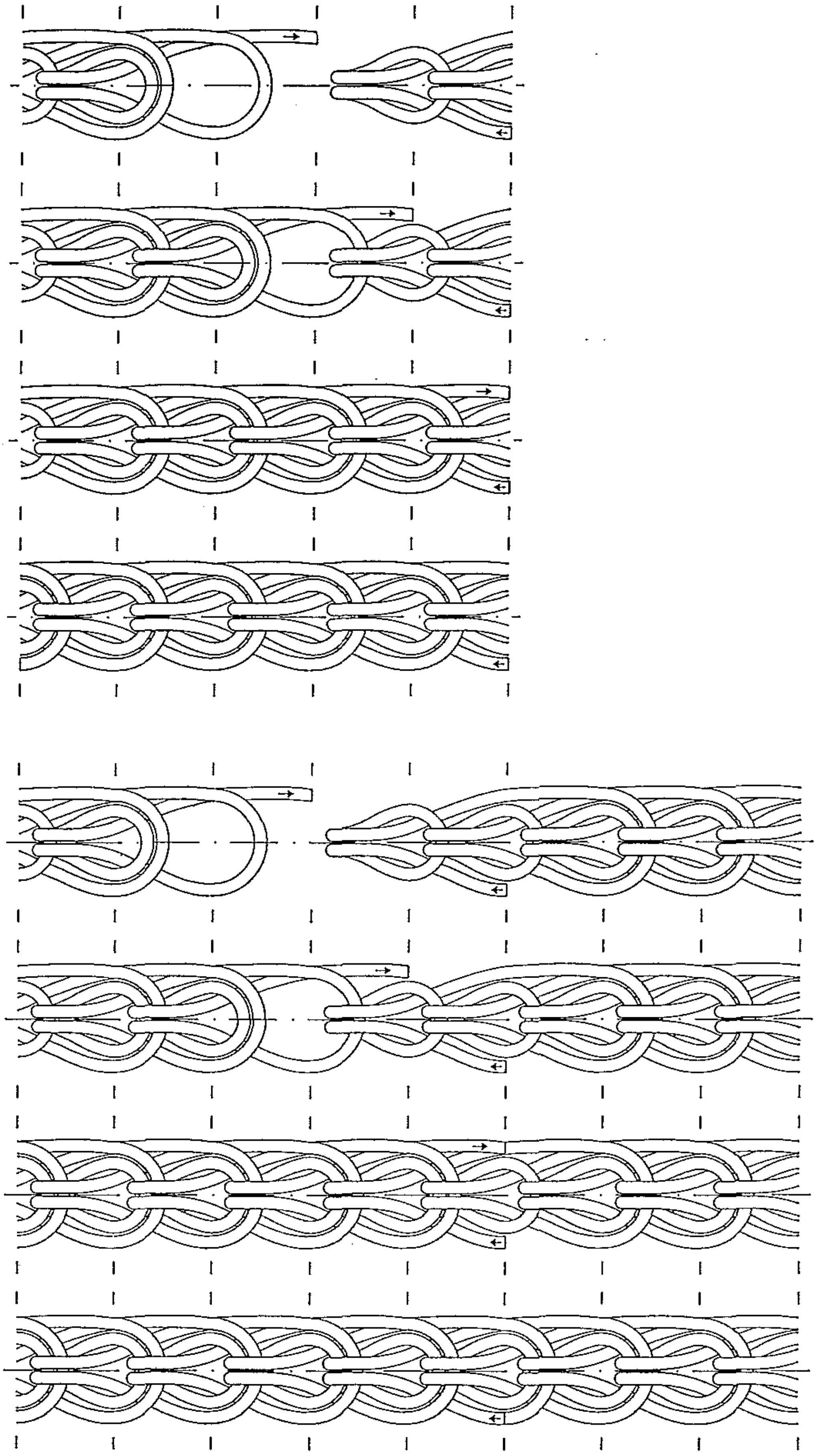


Fig. 1162 — The five and the eight pointed Perfect Star Knot.

Consequently the development of the single string Star Knot by P. P. O. Harrison in Fig. 1163, which has the mirror-imaged string-run layout of the n pointed single string Star Knot in Figs. 1162 and 1164, cannot be regarded as an achievement of some importance (refer to the Harrison Book of Knots pg. 22, No. 39; pg. 27, No. 55; pg. 93, No. 7; pp. 108-109).

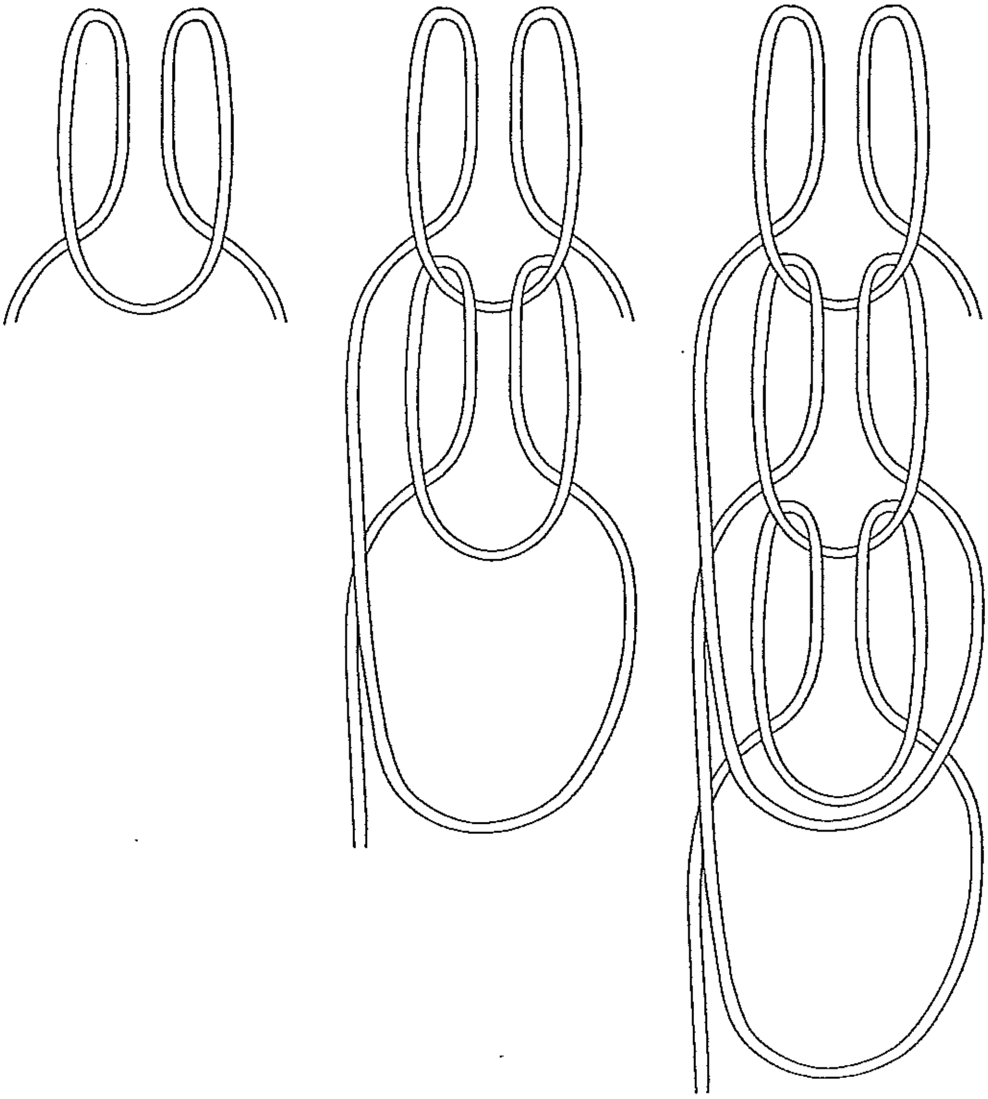


Fig. 1163 — String-run layout of the single string Star Knot by P. P. O. Harrison.

Note that the Perfect Star Knot should not be confused with Solly's single strand Star Knot, nor with any of the various variations of it.[†]

The string-runs of the five pointed Standard Star Knot and of the eight pointed Standard Star Knot are depicted once again in Fig. 1165 while their mirror-imaged string-runs are shown in Fig. 1166.

The first two braiding stages of these respective string-runs are shown in Fig. 1167 and Fig. 1168.

The last two braiding stages of the five pointed Standard Star Knot and of the eight pointed Standard Star Knot are shown in respectively Fig. 1169 and Fig. 1170.

[†] Refer to **Solly's Single Strand Star & variations on the theme** by Stuart Grainger, published by the International Guild of Knot Tyers.

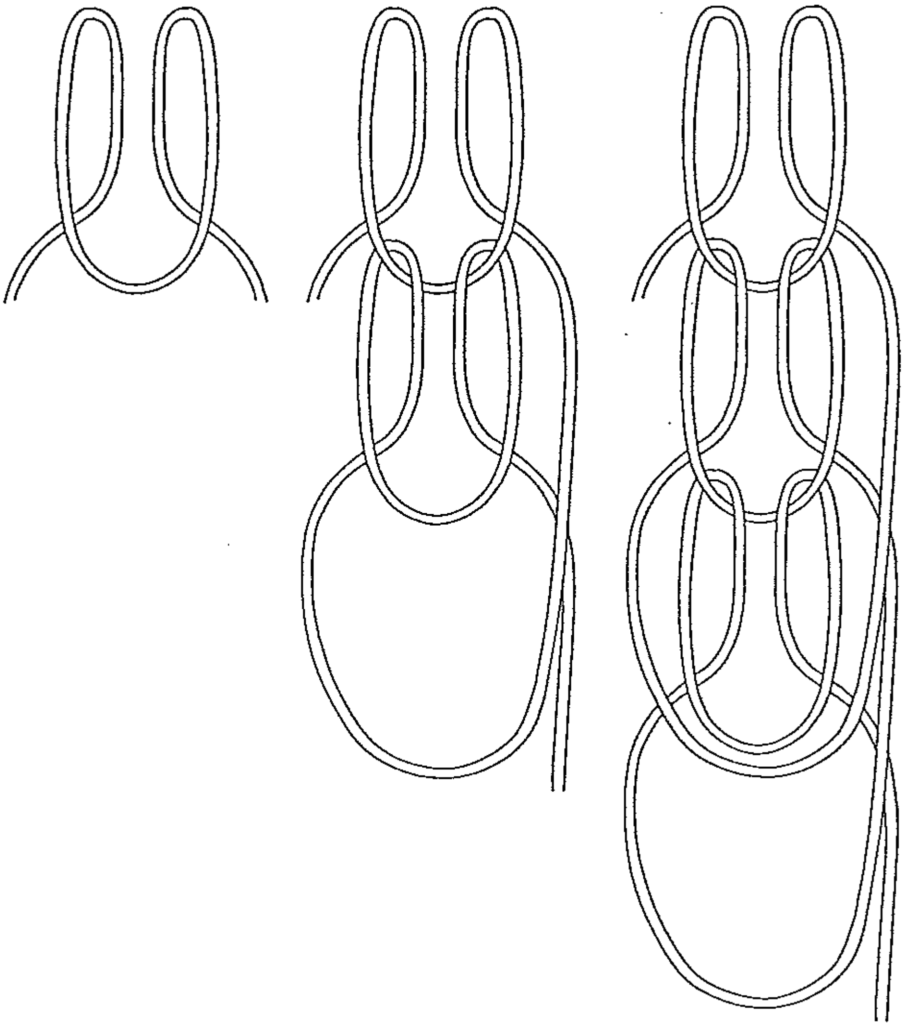


Fig. 1164 — The mirror-imaged string-run of Fig. 1163.

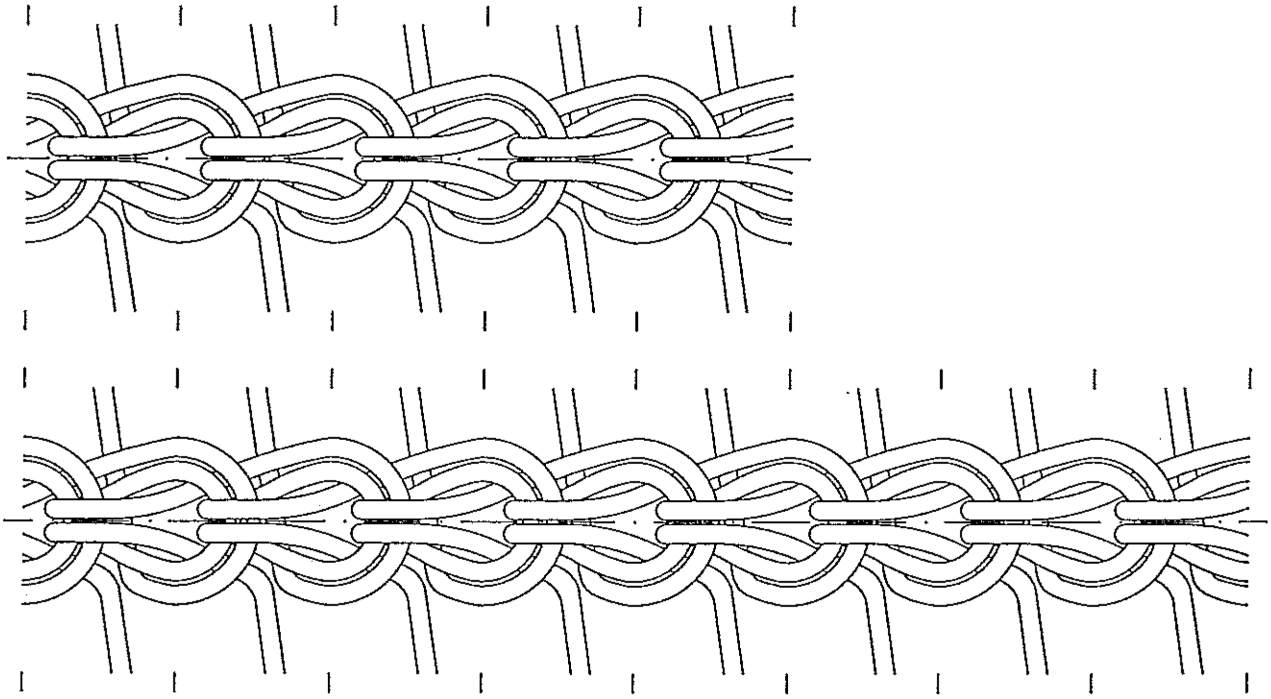


Fig. 1165 — The five and the eight pointed Standard Star Knot.

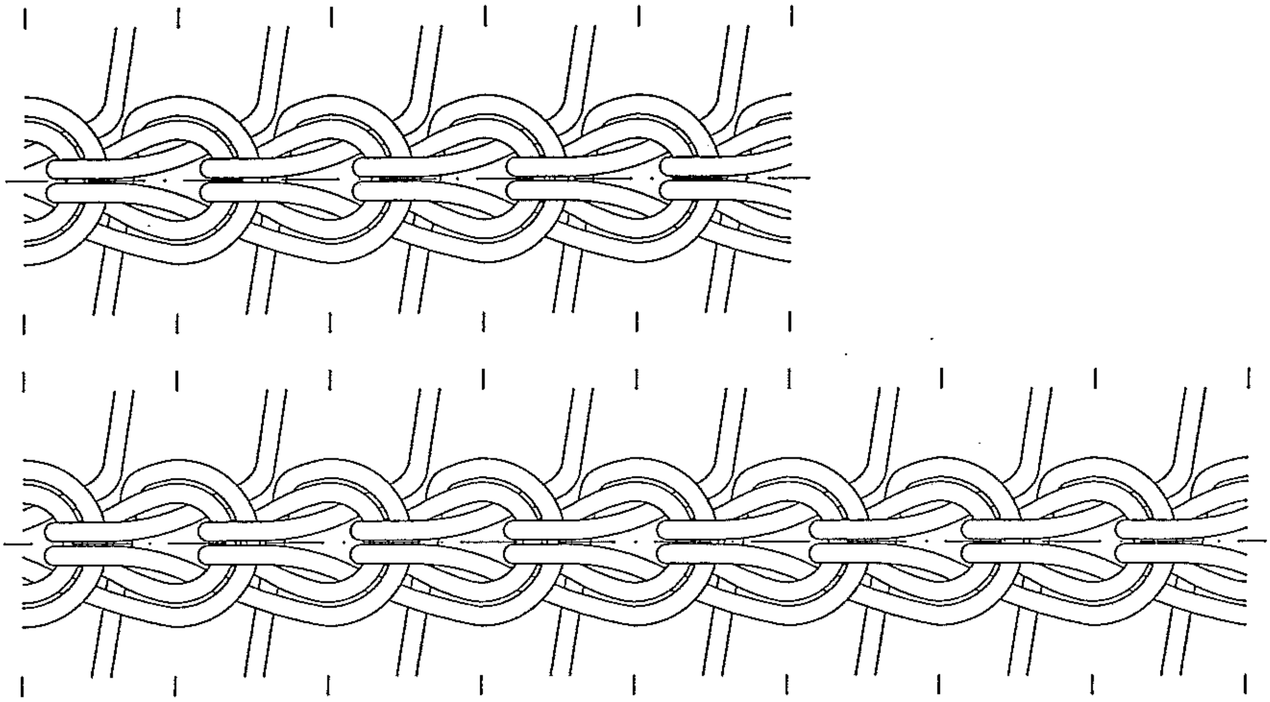


Fig. 1166 — The mirror-imaged string-runs of Fig. 1165.

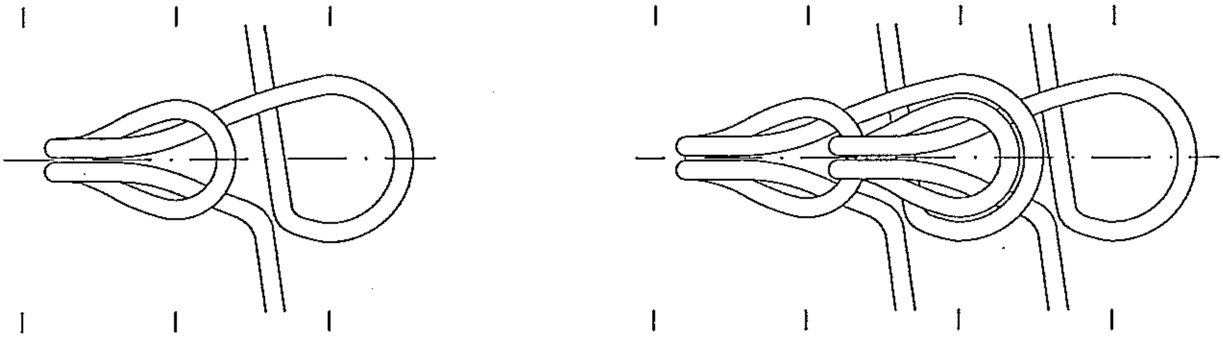


Fig. 1167 — The first two braiding stages of the string-runs in Fig. 1165.

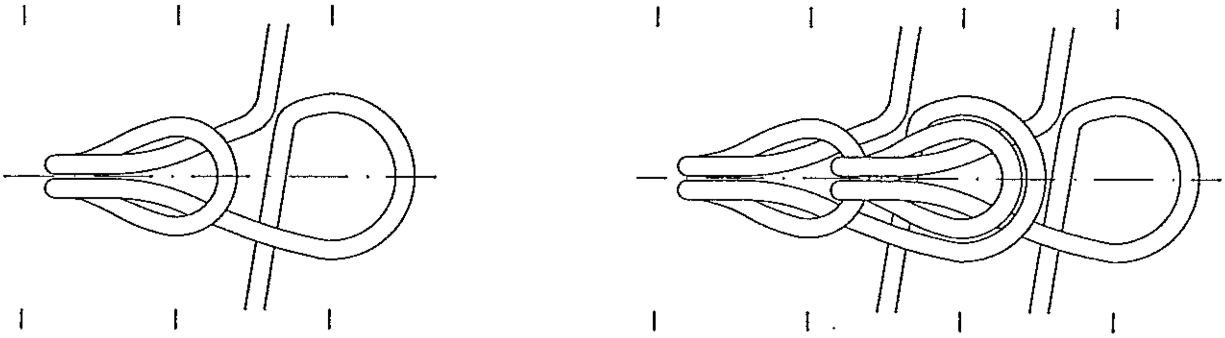


Fig. 1168 — The first two braiding stages of the string-runs in Fig. 1166.

Modifying the string-runs in Figs. 1165, 1166, 1167, 1168, 1169 and 1170 to those in respectively Figs. 1171, 1172, 1173, 1174, 1175 and 1176 results in a greater formfastness of the knots.

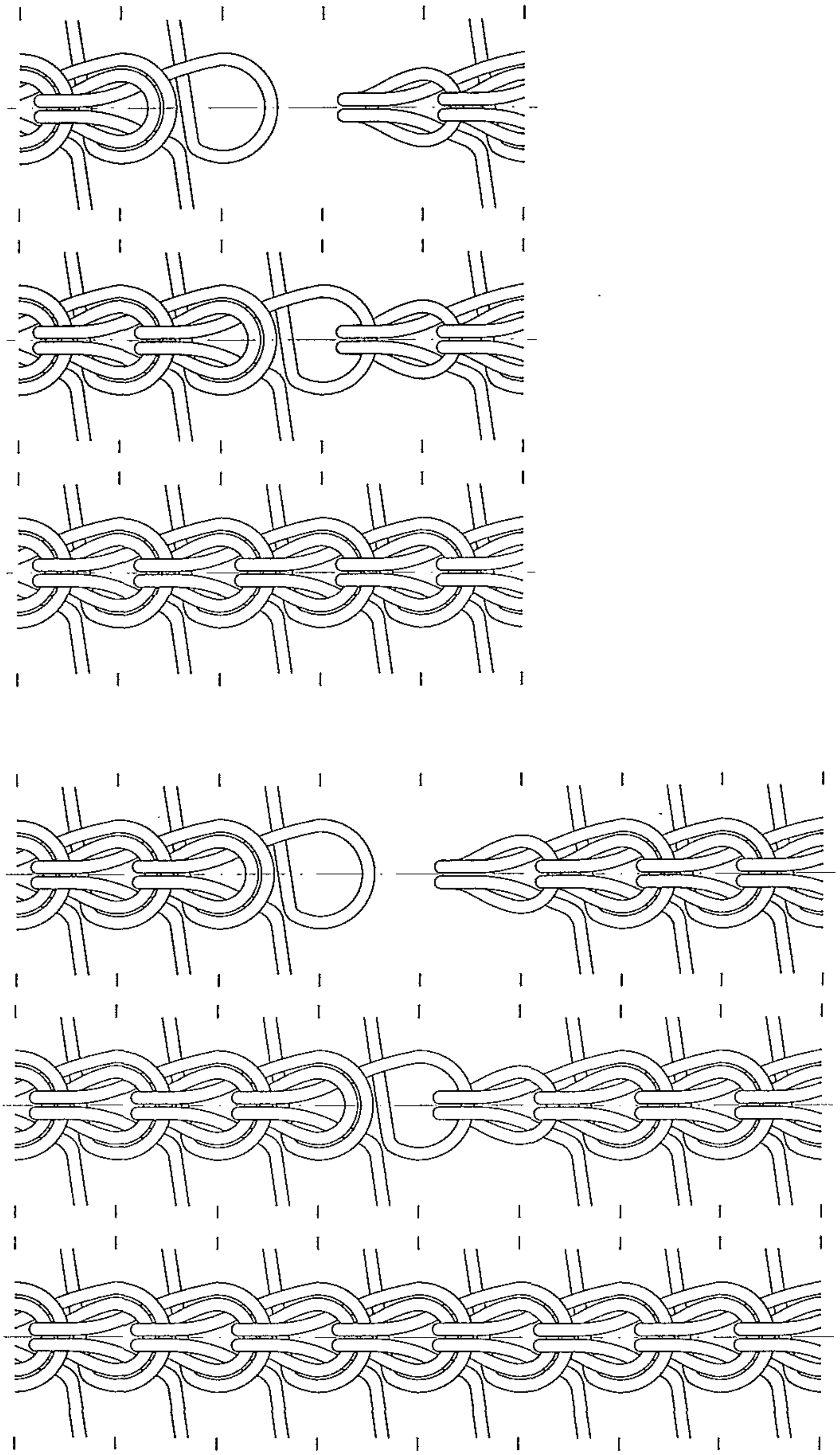


Fig. 1169 — The last two braiding stages of the string-run in Fig. 1165.

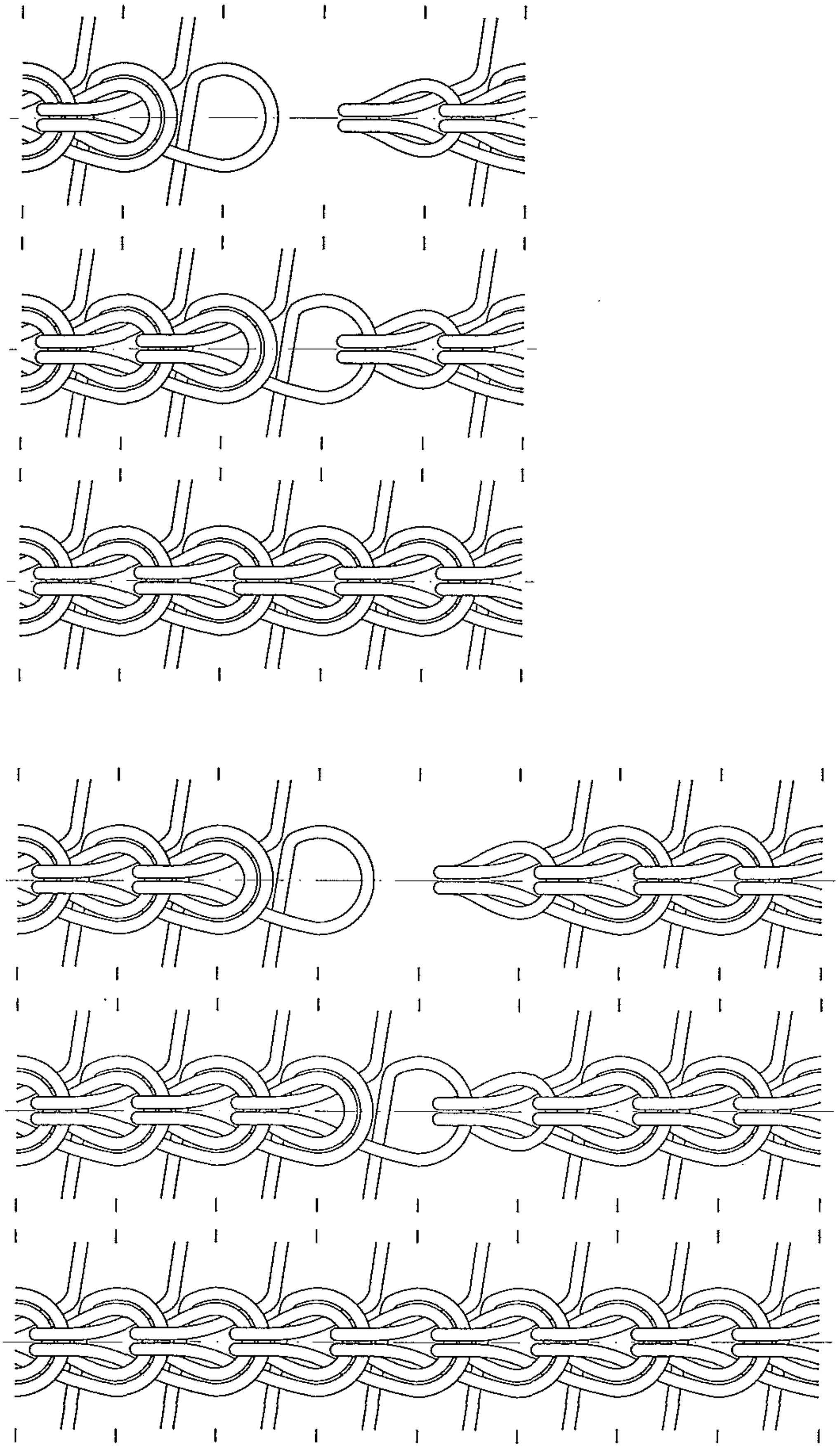


Fig. 1170 — The last two braiding stages of the string-run in Fig. 1166.

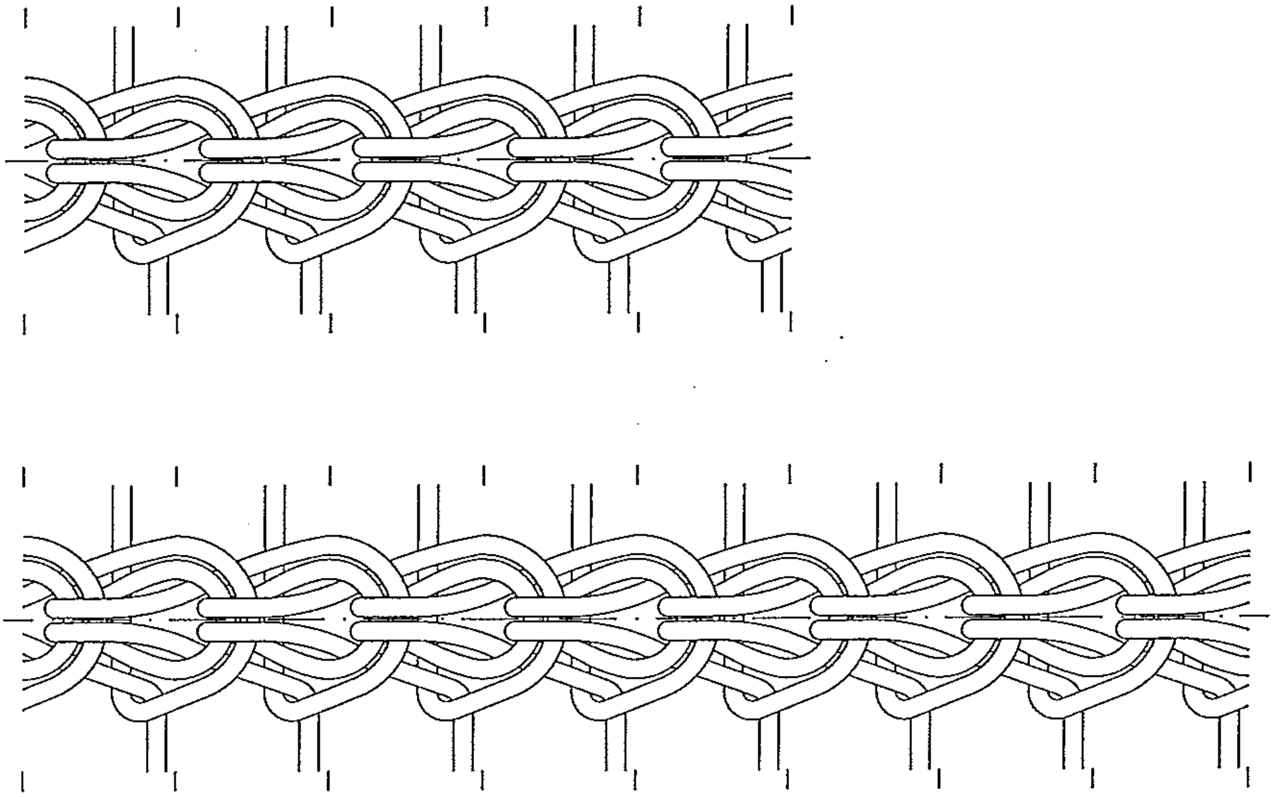


Fig. 1171 — The more formfast five and eight pointed Standard Star Knot.

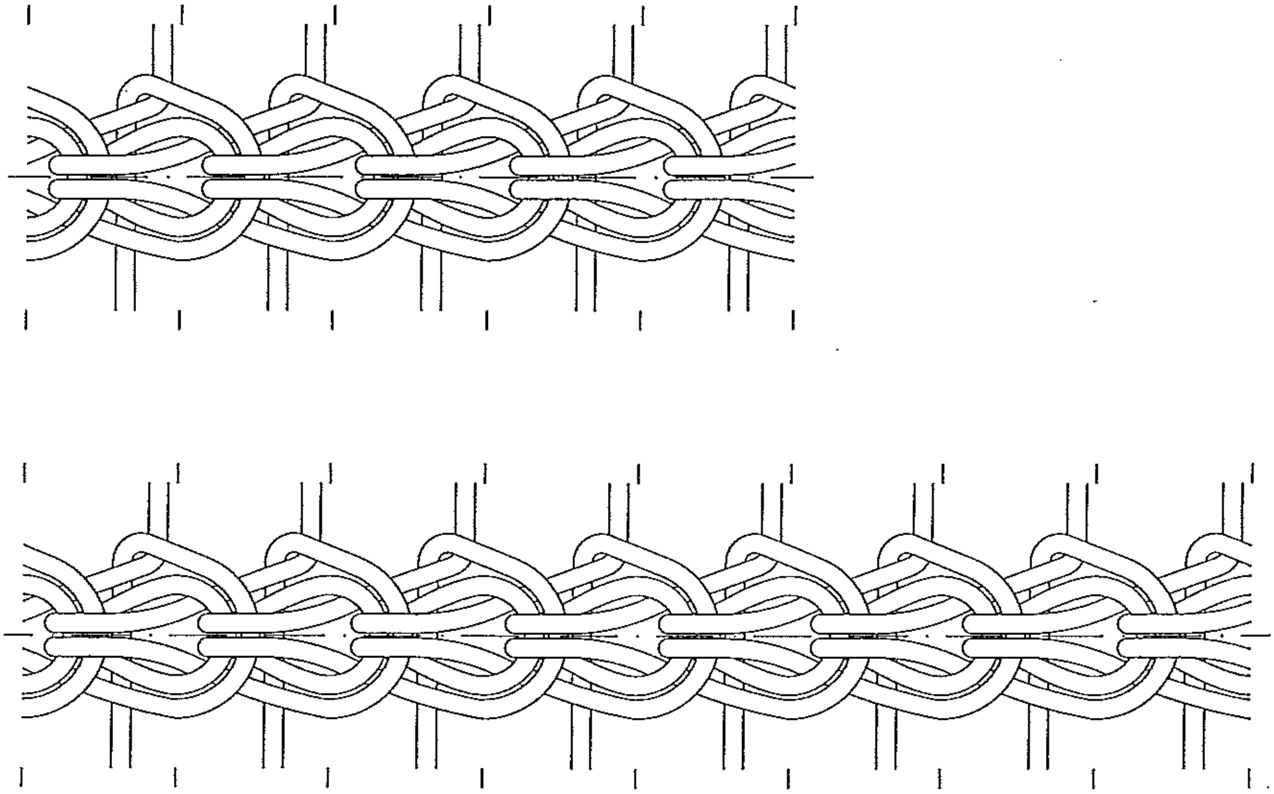


Fig. 1172 — The mirror-imaged string-runs of Fig. 1171.

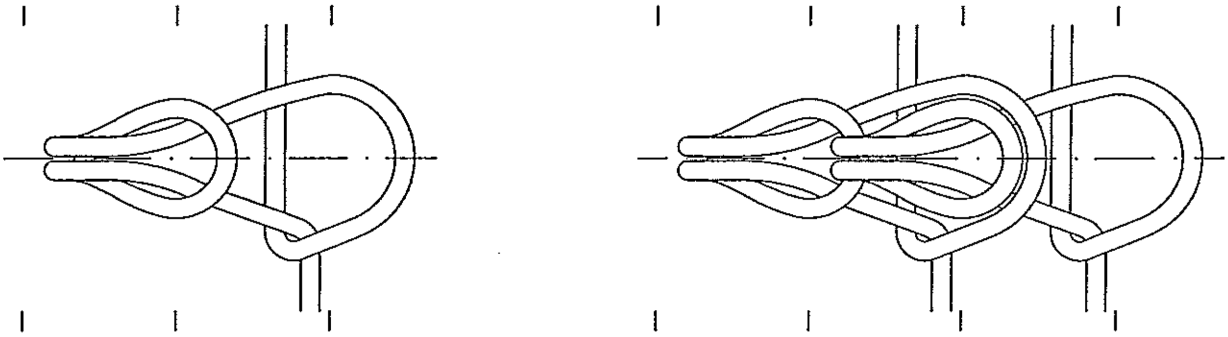


Fig. 1173 — The first two braiding stages of the string-runs in Fig. 1171.

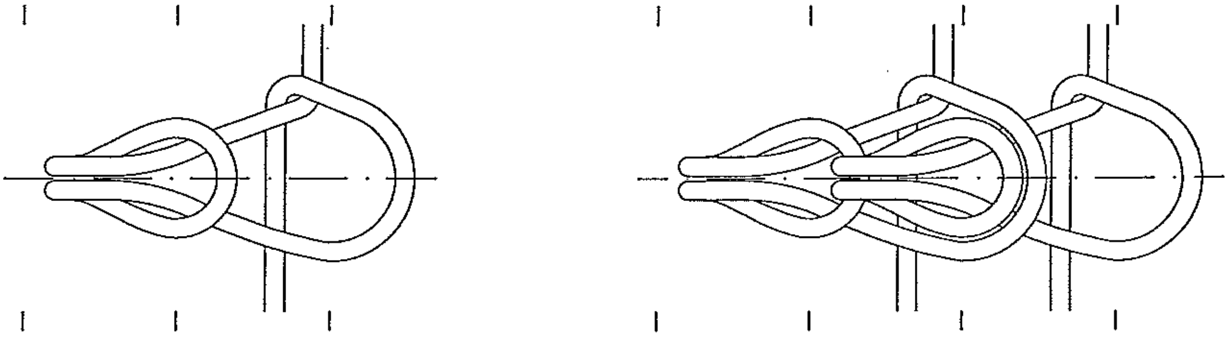


Fig. 1174 — The first two braiding stages of the string-runs in Fig. 1172.

The collar forming multi-pointed Standard Star Knot in a Saturn Knot is an integral part of the Saturn Knot's string-run. Hence a Saturn Knot consists of a foundation knot, where the string-run of this foundation knot is modified by incorporating the string-run of the collar forming multi-pointed Standard Star Knot. To facilitate the braiding process, we can first braid the foundation knot and then replace its string by a new string which incorporates in its string-run the string-run sections of the Standard Star Knot. The easiest to braid Saturn Knots are then those where the incorporated string-run sections of the Standard Star Knot are consecutive; this facilitates in obtaining the desired tightness in the multi-pointed Star Knot.

Example 1.

Let in this simple, and easy to braid Saturn knot, the foundation knot be the upper-left or lower-left Regular Knot with $p/b = 25/24$ in Fig. 1177. Euclid's algorithm with the path-formula in the RKT and the respective algorithm diagrams for these Regular Knots are presented in Fig. 1178. Both algorithm diagrams give us the same half-cycle braiding sequences which are as follows:

half-cycle 1 : Free Run.
half-cycle 2 $i = 0$: o .
half-cycle 3 $i = 0$: u .
half-cycle 4 $i \leq 1$: $2o$.
half-cycle 5 $i \leq 1$: $2u$.
half-cycle 6 $i \leq 2$: $3o$.
half-cycle 7 $i \leq 2$: $3u$.
half-cycle 8 $i \leq 3$: $u - 3o$.

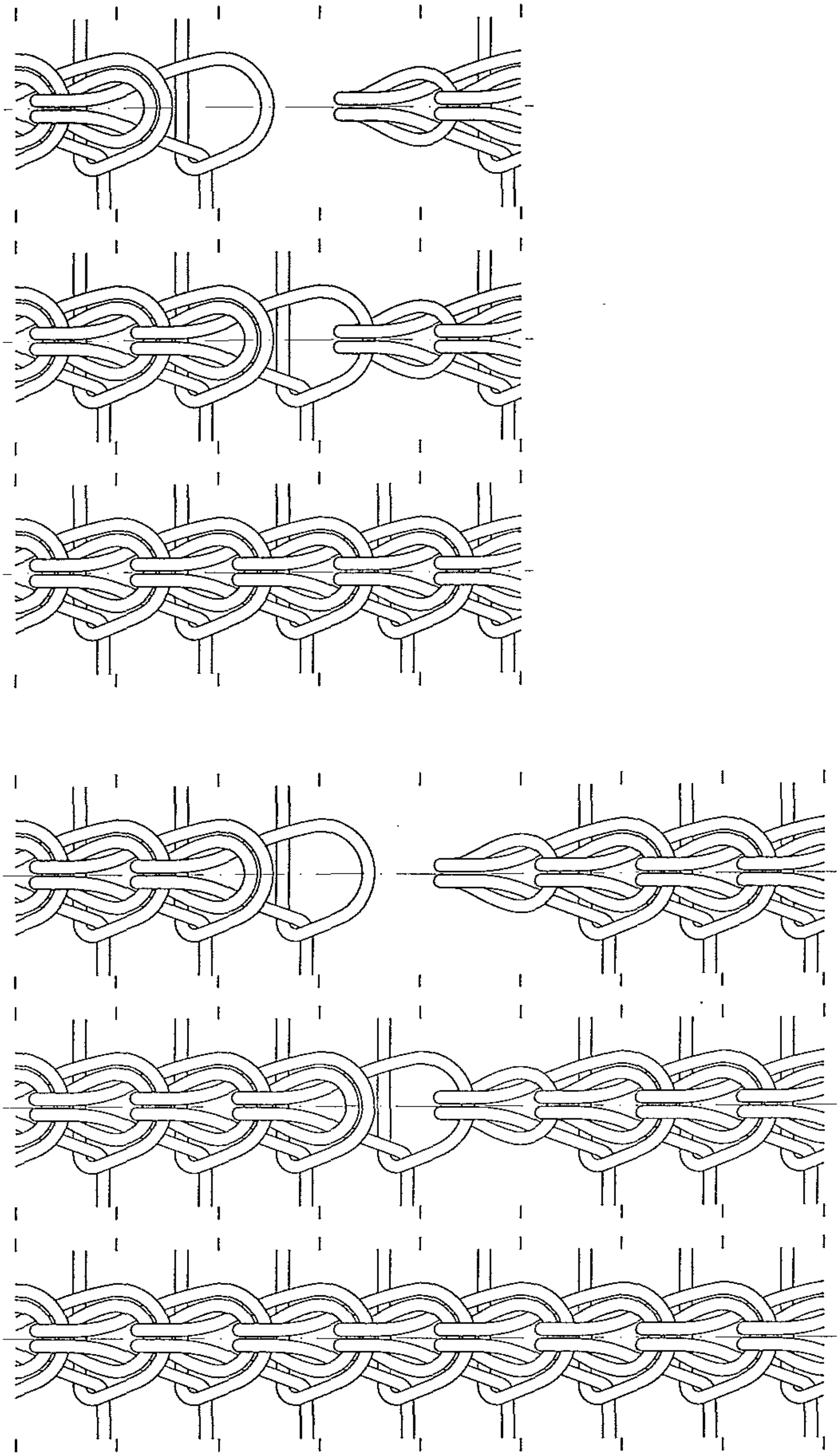


Fig. 1175 — The last two braiding stages of the string-run in Fig. 1171.

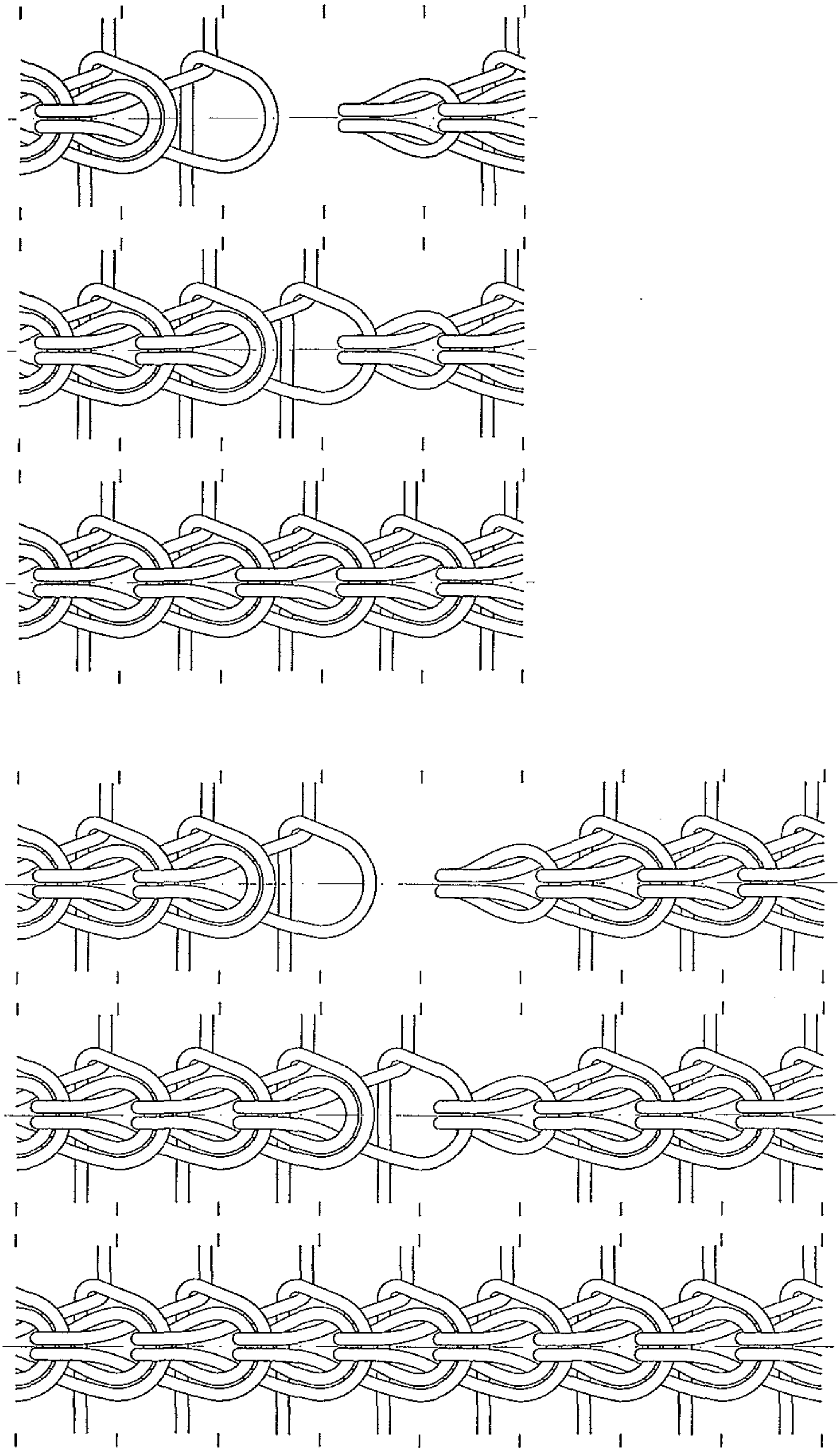
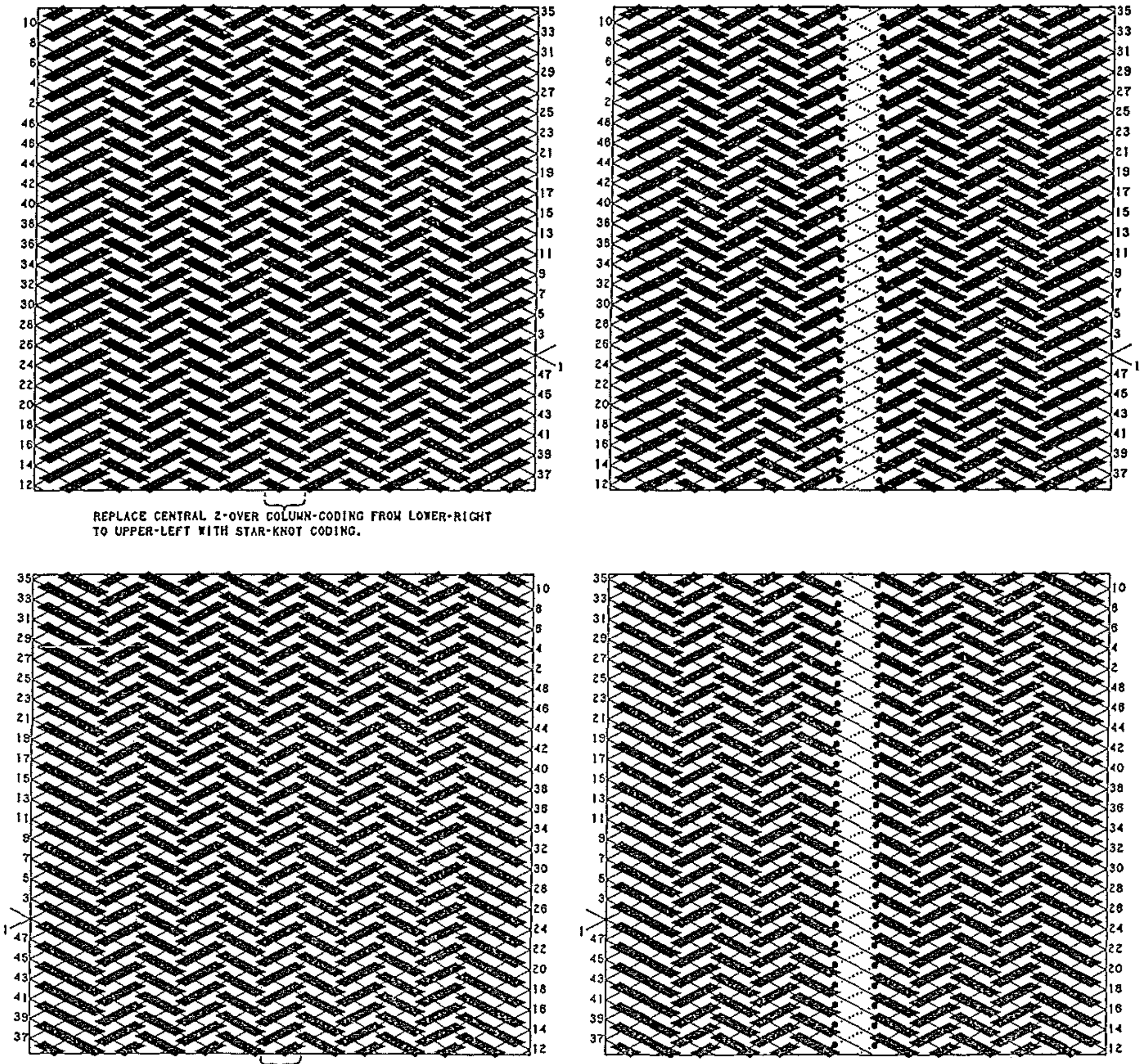


Fig. 1176 — The last two braiding stages of the string-run in Fig. 1172.

half-cycle 9 $i \leq 3$: $o - 3u$.
half-cycle 10 $i \leq 4$: $2u - 3o$.
half-cycle 11 $i \leq 4$: $2o - 3u$.
half-cycle 12 $i \leq 5$: $o - 2u - 3o$.



REPLACE CENTRAL 2-OVER COLUMN-CODING FROM LOWER-RIGHT TO UPPER-LEFT WITH STAR-KNOT CODING.

REPLACE CENTRAL 2-OVER COLUMN-CODING FROM LOWER-LEFT TO UPPER-RIGHT WITH STAR-KNOT CODING.

Fig. 1177 — The foundation knot $p/b = 25/24$ in Example 1.

half-cycle 13 $i \leq 5$: $u - 2o - 3u$.
half-cycle 14 $i \leq 6$: $2u - 2u - 3o$.
half-cycle 15 $i \leq 6$: $2u - 2o - 3u$.
half-cycle 16 $i \leq 7$: $u - 2o - 2u - 3o$.
half-cycle 17 $i \leq 7$: $o - 2u - 2o - 3u$.
half-cycle 18 $i \leq 8$: $2u - 2o - 2u - 3o$.
half-cycle 19 $i \leq 8$: $2o - 2u - 2o - 3u$.
half-cycle 20 $i \leq 9$: $o - 2u - 2o - 2u - 3o$.
half-cycle 21 $i \leq 9$: $u - 2o - 2u - 2o - 3u$.

half-cycle 22 $i \leq 10$: $2o - 2u - 2o - 2u - 3o$.
half-cycle 23 $i \leq 10$: $2u - 2o - 2u - 2o - 3u$.
half-cycle 24 $i \leq 11$: $u - 2o - 2u - 2o - 2u - 3o$.
half-cycle 25 $i \leq 11$: $o - 2u - 2o - 2u - 2o - 3u$.
half-cycle 26 $i \leq 12$: $2u - 2o - 2u - 2o - 2u - 3o$.

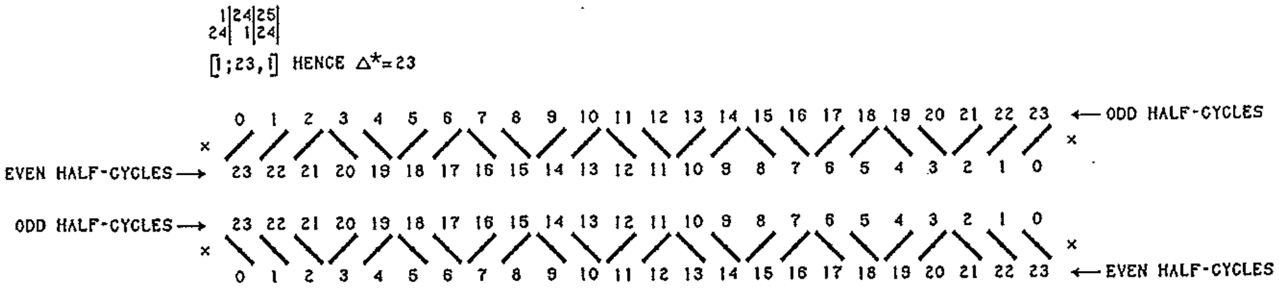


Fig. 1178 — Euclid's algorithm, path formula in RKT and algorithm diagram for the foundation knot.

half-cycle 27 $i \leq 12$: $2o - 2u - 2o - 2u - 2o - 3u$.
half-cycle 28 $i \leq 13$: $o - 2u - 2o - 2u - 2o - 2u - 3o$.
half-cycle 29 $i \leq 13$: $u - 2o - 2u - 2o - 2u - 2o - 3u$.
half-cycle 30 $i \leq 14$: $2o - 2u - 2o - 2u - 2o - 2u - 3o$.
half-cycle 31 $i \leq 14$: $2u - 2o - 2u - 2o - 2u - 2o - 3u$.
half-cycle 32 $i \leq 15$: $u - 2o - 2u - 2o - 2u - 2o - 2u - 3o$.
half-cycle 33 $i \leq 15$: $o - 2u - 2o - 2u - 2o - 2u - 2o - 3u$.
half-cycle 34 $i \leq 16$: $2u - 2o - 2u - 2o - 2u - 2o - 2u - 3o$.
half-cycle 35 $i \leq 16$: $2o - 2u - 2o - 2u - 2o - 2u - 2o - 3u$.
half-cycle 36 $i \leq 17$: $o - 2u - 2o - 2u - 2o - 2u - 2o - 2u - 3o$.
half-cycle 37 $i \leq 17$: $u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - 3u$.
half-cycle 38 $i \leq 18$: $2o - 2u - 2o - 2u - 2o - 2u - 2o - 2u - 3o$.
half-cycle 39 $i \leq 18$: $2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - 3u$.
half-cycle 40 $i \leq 19$: $u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - 2u - 3o$.
half-cycle 41 $i \leq 19$: $o - 2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - 3u$.
half-cycle 42 $i \leq 20$: $2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - 2u - 3o$.
half-cycle 43 $i \leq 20$: $2o - 2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - 3u$.
half-cycle 44 $i \leq 21$: $o - 2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - 2u - 3o$.
half-cycle 45 $i \leq 21$: $u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - 3u$.
half-cycle 46 $i \leq 22$: $2o - 2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - 2u - 3o$.
half-cycle 47 $i \leq 22$: $2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - 3u$.
half-cycle 48 $i \leq 23$: $3o - 2u - 2o - 2u - 2o - 2u - 2o - 2u - 2o - 2u - 3o$.

After the foundation knot has been braided and properly tightened, we replace its string with a longer string which incorporates in its odd half-cycles associated with the upper-left diagram in Fig. 1177 the star knot elements as in Figs. 1166 , 1168 , 1170 or as in Figs. 1172 , 1174 , 1176; or which incorporates in its odd half-cycles associated with the lower-left diagram in Fig. 1177 the star knot elements as in Figs. 1165, 1167, 1169 or as in Figs. 1171, 1173, 1175. For 2mm. diameter string this Saturn Knot should fit properly over a cylinder with a diameter of about 25mm.

Example 2.

Let the foundation knot be a single string Regular Nested Knot (hence a Perfect Regular Nested Knot), hence g.c.d. $(\Delta, A) = 1$ and g.c.d. $(P_{\text{total}}, B^*) = 1)$.

After the foundation knot has been braided and properly tightened, we replace its string with a longer string that incorporates the star knot elements in its either odd or even half-cycles. In order to make the incorporation of the star knot elements as easy as possible, we ensure that any two consecutive odd or even half-cycles in the foundation knot are adjacent. Hence there are two cases to be considered:

1. The Standing End half-cycle 1 runs from lower-left bight-boundary 1 to upper-right bight-boundary 1. Since half-cycle 3 must be immediately adjacent to half-cycle 1, it follows that half-cycle 2 runs from lower-right bight-boundary 1 to upper-left bight-boundary A. Hence half-cycle 3 runs from lower-left bight-boundary A to upper-right bight-boundary 2. Thus for the first cycle, running from lower-left bight-boundary 1 to upper right bight-boundary 1, then from lower-right bight-boundary 1 to upper-left bight-boundary A we obtain:
$2(A-1)+x+2(A-1)+2(A-1)+x+2(A-A) = 2nAB^*+2A$, hence $x = nAB^*-2A+3$, where n is a natural number.

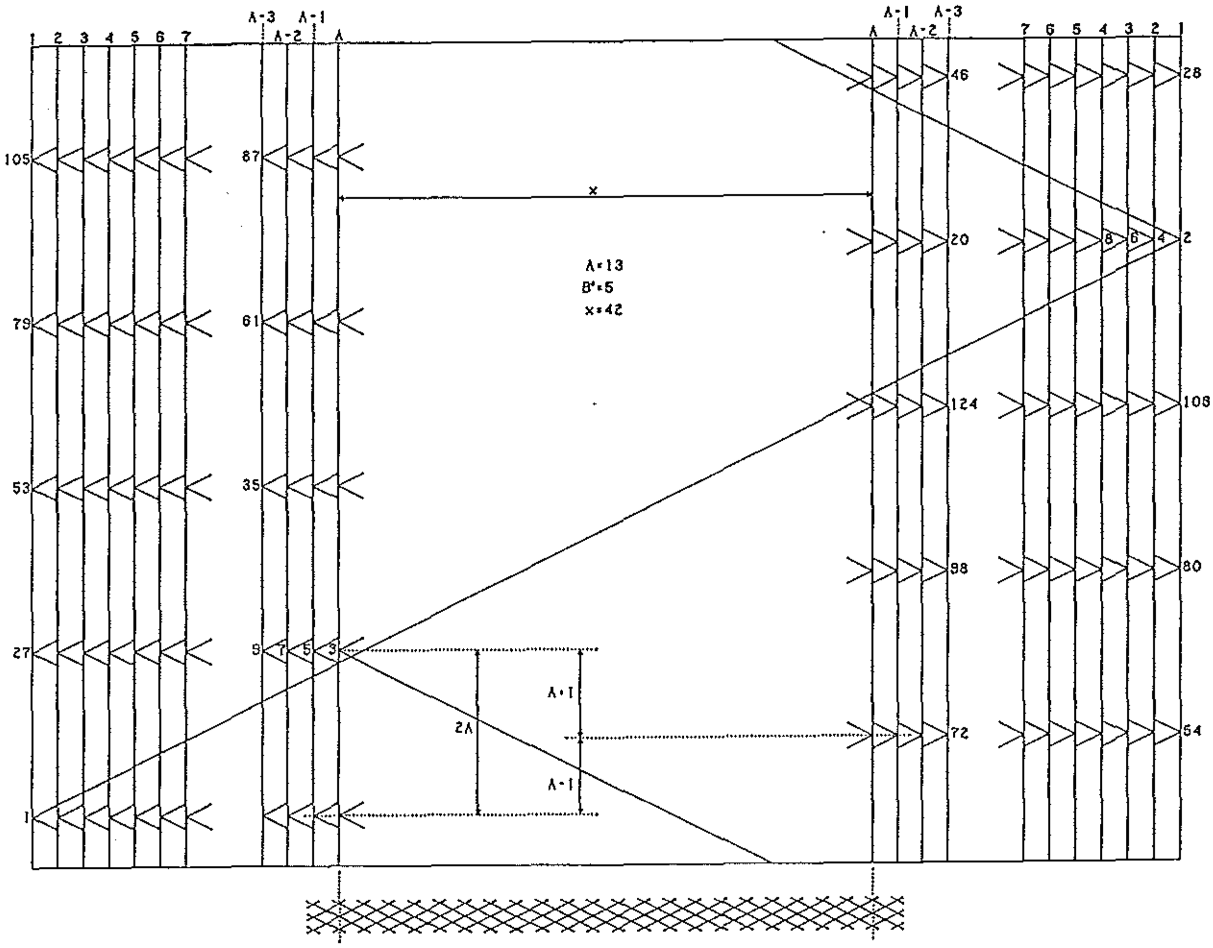


Fig. 1179 — A Perfect Regular Nested Knot with $A = 13$, $B^* = 5$, $x = 42$, $k = 1$.

2. The Standing End half-cycle 1 runs from lower-left bight-boundary 1 to upper-right bight-boundary A. Since half-cycle 3 must be immediately adjacent to half-cycle 1, it follows that half-cycle 2 runs from lower-right bight-boundary A to upper-left bight-boundary 2. Hence half-cycle 3 runs from lower-left bight-boundary 2 to upper-right bight-boundary (A-1). Thus for the first cycle, running from lower-left bight-boundary 1 to upper-right bight-boundary A, then from lower-right bight-boundary A to upper-left bight-boundary 2 we obtain:
$2(A-1)+x+2(A-A)+2(A-A)+x+2(A-2) = 2nAB^*$, hence $x = nAB^* - 2A+3$, where n is a natural number.

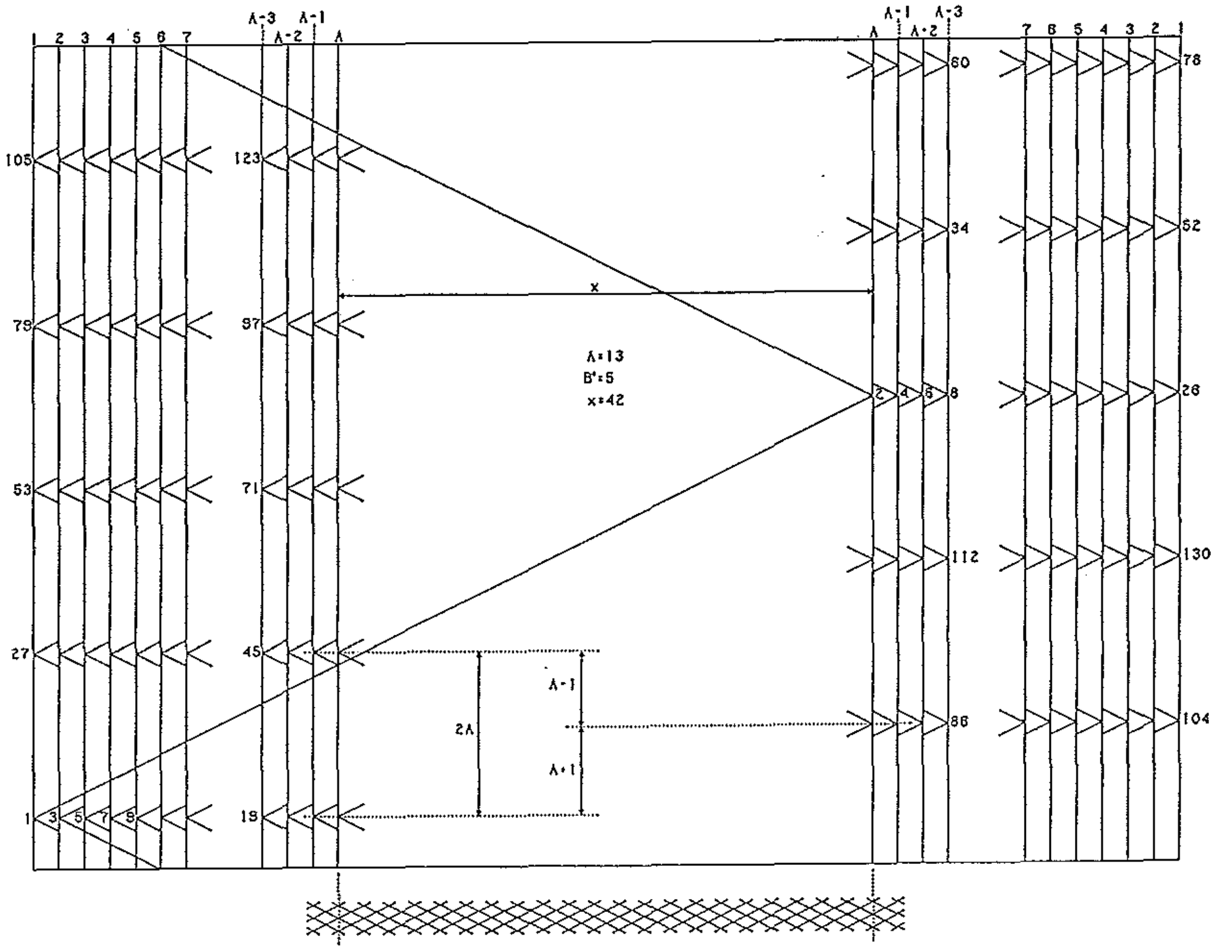


Fig. 1180 — A Perfect Regular Nested Knot with $A = 13$, $B^* = 5$, $x = 42$, $k = A$.

For case 1 the sequentially adjacent half-cycles are the odd-numbered half-cycles (see for example the string-run in Fig.1179 of a Perfect Regular Nested Knot with $A = 13$, $x = 42$, $k = 1$ and hence $y = |x - 2(k+1)|_{2A}{}^{\dagger} = |38|_{26} = 12 = A - 1$), while for case 2 the sequentially adjacent half-cycles are the even-numbered half-cycles (see for example the string-run in Fig.1180 of a Perfect Regular Nested Knot with $A = 13$, $x = 42$, $k = A = 13$ and hence $y = |x - 2(k+1)|_{2A} = |14|_{26} = 14 = A + 1$).

Let the foundation knot be spherical ball. For a spherical ball the circumference over the poles is equal to the circumference over the equator. With the odd half-cycles crossing the even half-cycles at the equator at about 90°, the circumference over the poles is about equal to $2 \times (2 \times \frac{A-1}{2} + \frac{x}{2})$ bight units, hence is about equal to

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† Refer to *The Braider*, Issue No. 25, pg. 567.

$2A - 2 + x = B$ bight units.[†] Hence for a single string spherical Regular Nested Knot with $A = 6$ and $B^* = 5$ we require x to be about $B - 2A + 2 = 6 \times 5 - 2 \times 6 + 2 = 20$, while $x = nAB^* - 2A + 3 = 1 \times 6 \times 5 - 2 \times 6 + 3 = 21$ for $n = 1$ in both cases **1** and **2**.

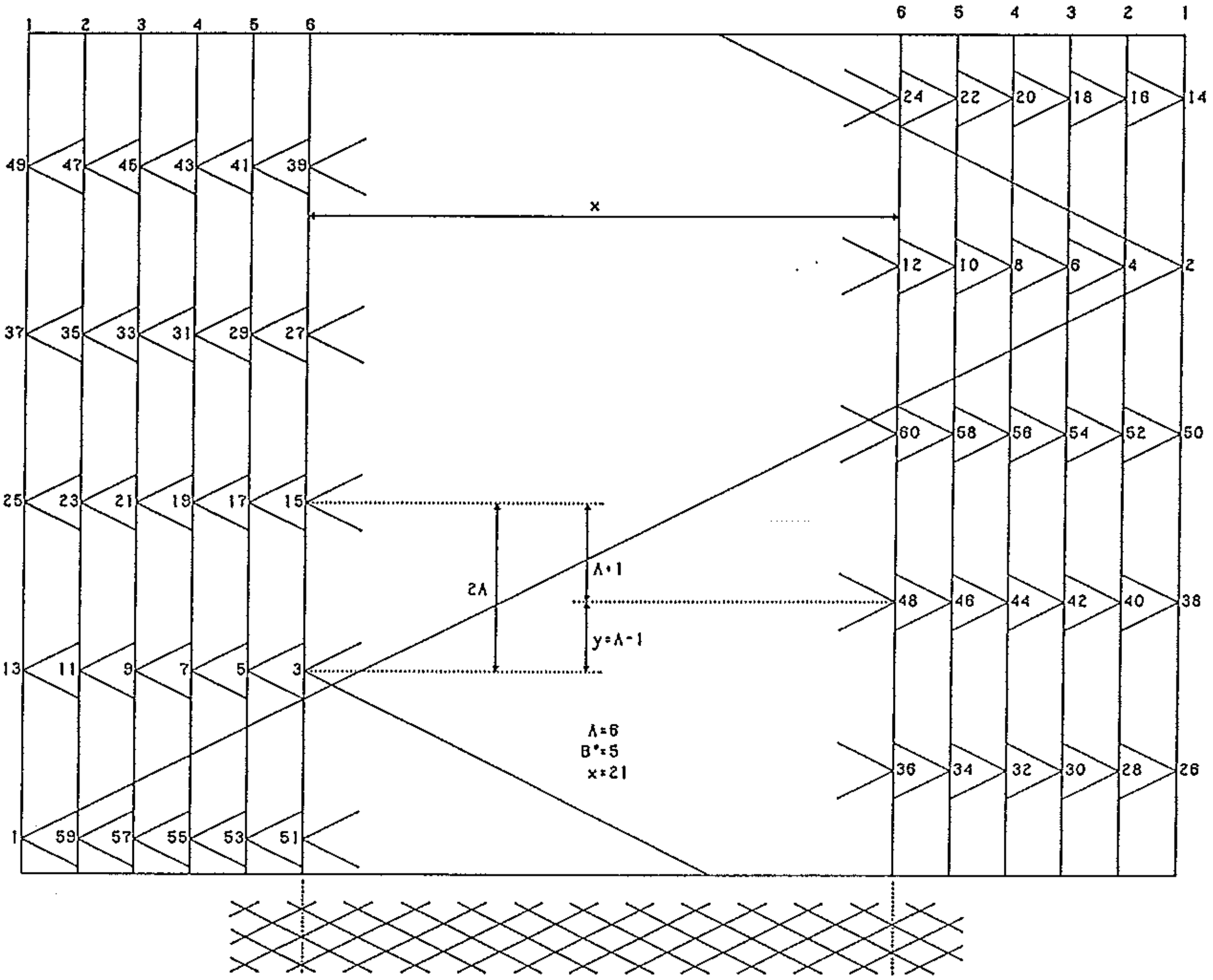


Fig. 1181 — A Perfect Regular Nested Knot with $A = 6$, $B^* = 5$, $x = 21$, $k = 1$.

The full string-run of the single string spherical Regular Nested knot of Fig. 1181 with $A = 6$, $B^* = 5$, $x = 21$, $k = 1$, hence with $y = |x - 2(k+1)|_{2A} = |17|_{12} = 5 = A - 1$, and $\Delta = |x - 2(k+1)|_A = |17|_6 = 5 = |y|_A$[††] and $B = A.B^* = 30$, is depicted in Fig. 1182. After superimposing a suitable coding on the string-run in Fig. 1182 we obtain Fig. 1183.

At the upper left-hand side in Fig. 1184 is shown the first-return string-run with its associated nest-index numbers.

At the upper right-hand side in Fig. 1184 are depicted the first-return string-run, the half-cycle numbers of the half-cycles, and the number of crossings which these half-cycles make in the finished knot.

From the half-cycle pattern at the bottom of Fig. 1184 we assemble, in assocition with the superimposed coding, the half-cycle tables in Fig. 1185.[‡]

[†] Recall that also $2A + x - 2 = P_{\text{total}}$.

[††] Refer to *The Braider*, Issue No. 25, pg. 567.

[‡] Refer to *The Braider*, Issue No. 28.

From the half-cycle tables in Fig. 1185 we then read the half-cycle braiding algorithms for the Perfect Regular Nested Knot in Fig. 1183 as follows:

1. 1 ↗ 1: Free run.
2. 1 ↖ 6: *o*.
3. 6 ↗ 2: Free run.
4. 2 ↖ 5: *u*.
5. 5 ↗ 3: Free run.
6. 3 ↖ 4: *o*.
7. 4 ↗ 4: Free run.
8. 4 ↖ 3: *u*.
9. 3 ↗ 5: Free run.
10. 5 ↖ 2: *o*.
11. 2 ↗ 6: Free run.
12. 6 ↖ 1: *u*.

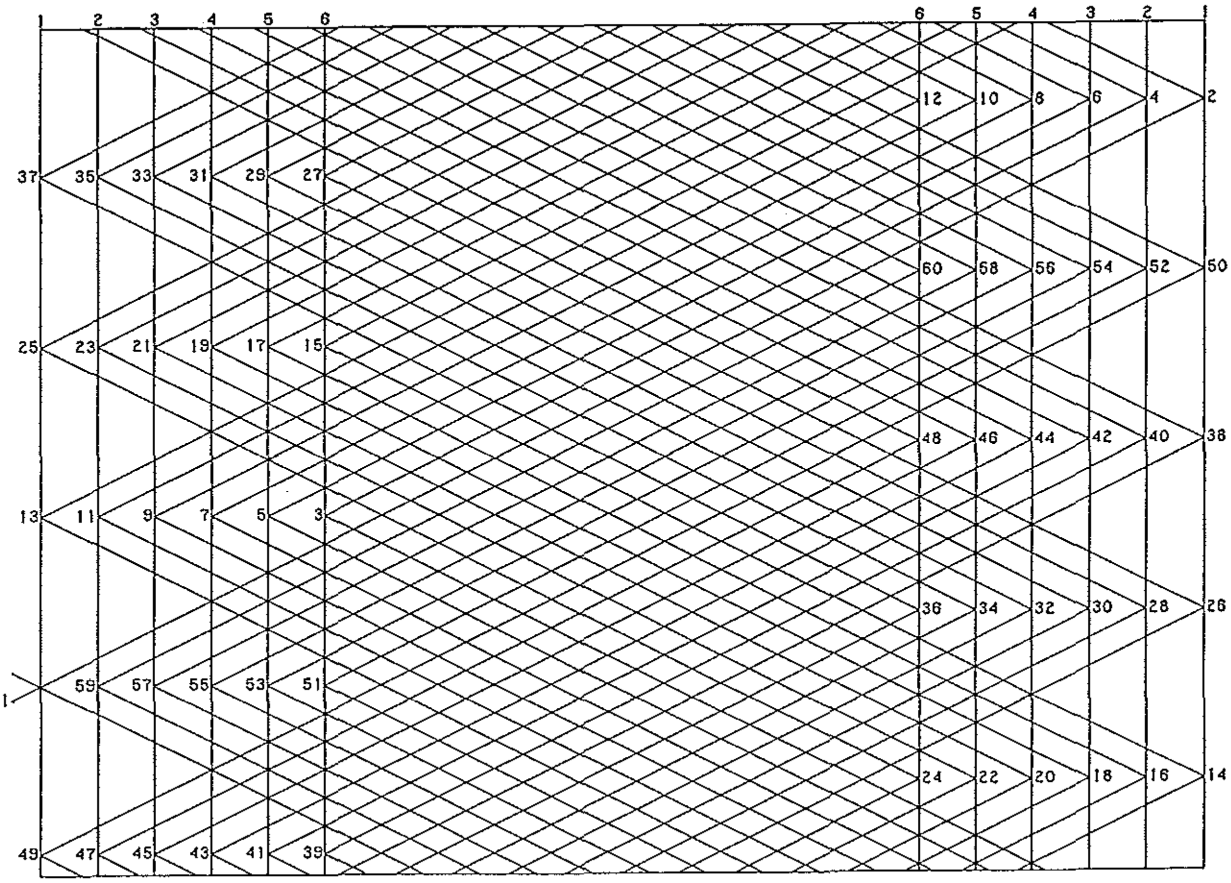


Fig. 1182 — The string-run of the single string spherical Regular Nested Knot with $A = 6$, $B^* = 5$, $x = 21$, $k = 1$.

13. 1 ↗ 1: $u - o - u - o - u - o$.
14. 1 ↖ 6: $o - 3u - 3o$.
15. 6 ↗ 2: $2u - o - u - o - u$.
16. 2 ↖ 5: $3u - 3o - u$.
17. 5 ↗ 3: $3u - o - u - o$.
18. 3 ↖ 4: $2u - 3o - u - o$.
19. 4 ↗ 4: $o - 3u - o - u$.
20. 4 ↖ 3: $u - 3o - u - o - u$.

21. $3 \nearrow 5$: $2o - 3u - o$.
22. $5 \nwarrow 2$: $3o - u - o - u - o$.
23. $2 \nearrow 6$: $3o - 3u$.
24. $6 \nwarrow 1$: $2o - u - o - u - o - u$.
25. $1 \nearrow 1$: $u - 3o - 3u - o - u - o - u - o$.

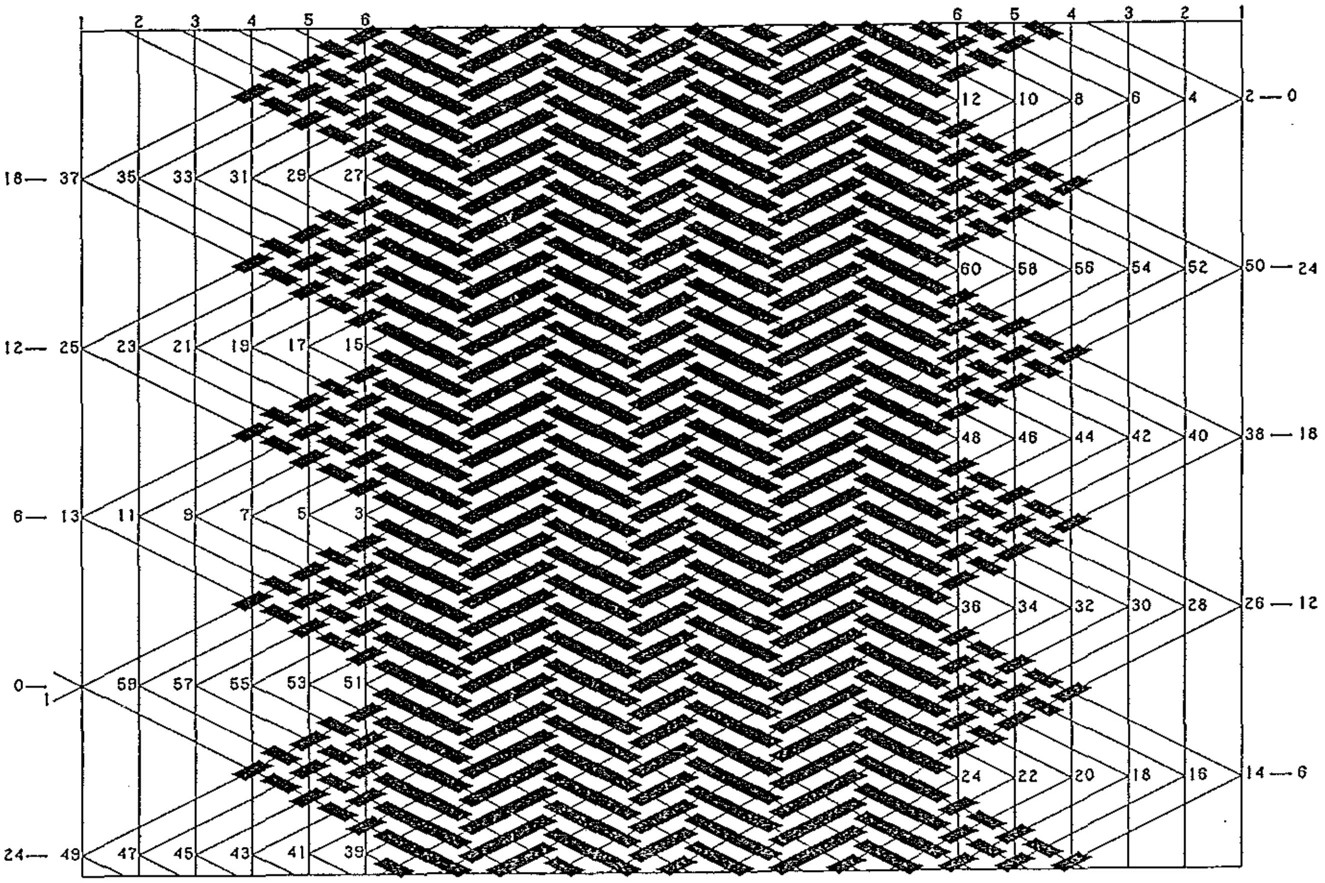


Fig. 1183 — The grid-diagram of the single string spherical Regular Nested Knot with $A = 6$, $B^* = 5$, $x = 21$, $k = 1$.

26. $1 \nwarrow 6$: $2o - 2u - 3o - 3u - 3o$.
27. $6 \nearrow 2$: $2u - 3o - 3u - o - u - o - u$.
28. $2 \nwarrow 5$: $o - 2u - 3o - 3u - 3o - u$.
29. $5 \nearrow 3$: $3u - 3o - 3u - o - u - o$.
30. $3 \nwarrow 4$: $2u - 3o - 3u - 3o - u - o$.
31. $4 \nearrow 4$: $o - 3u - 3o - 3u - o - u$.
32. $4 \nwarrow 3$: $u - 3o - 3u - 3o - u - o - u$.
33. $3 \nearrow 5$: $2o - 3u - 3o - 3u - o$.
34. $5 \nwarrow 2$: $3o - 3u - 3o - u - o - u - o$.
35. $2 \nearrow 6$: $u - 2o - 3u - 3o - 3u$.
36. $6 \nwarrow 1$: $2o - 3u - 3o - u - o - u - o - u$.
37. $1 \nearrow 1$: $2u - 2o - 3u - 3o - 3u - o - u - o - u - o$.
38. $1 \nwarrow 6$: $2o - 3u - 3o - 2u - 3o - 3u - 3o$.
39. $6 \nearrow 2$: $3u - 2o - 3u - 3o - 3u - o - u - o - u$.
40. $2 \nwarrow 5$: $o - 3u - 3o - 2u - 3o - 3u - 3o - u$.
41. $5 \nearrow 3$: $o - 3u - 2o - 3u - 3o - 3u - o - u - o$.
42. $3 \nwarrow 4$: $3u - 3o - 2u - 3o - 3u - 3o - u - o$.

43. 4 ↗ 4: 2o − 3u − 2o − 3u − 3o − 3u − o − u .
44. 4 ↖ 3: 2u − 3o − 2u − 3o − 3u − 3o − u − o − u .
45. 3 ↗ 5: 3o − 3u − 2o − 3u − 3o − 3u − o .
46. 5 ↖ 2: u − 3o − 2u − 3o − 3u − 3o − u − o − u − o .
47. 2 ↗ 6: u − 3o − 3u − 2o − 3u − 3o − 3u .
48. 6 ↖ 1: 3o − 2u − 3o − 3u − 3o − u − o − u − o − u .
49. 1 ↗ 1: 2u − 3o − 3u − 2o − 3u − 3o − 3u − o − u − o − u − o .
50. 1 ↖ 6: u − o − u − o − u − 3o − 3u − 3o − 2 − 3o − 3u − 3ou − o − u .

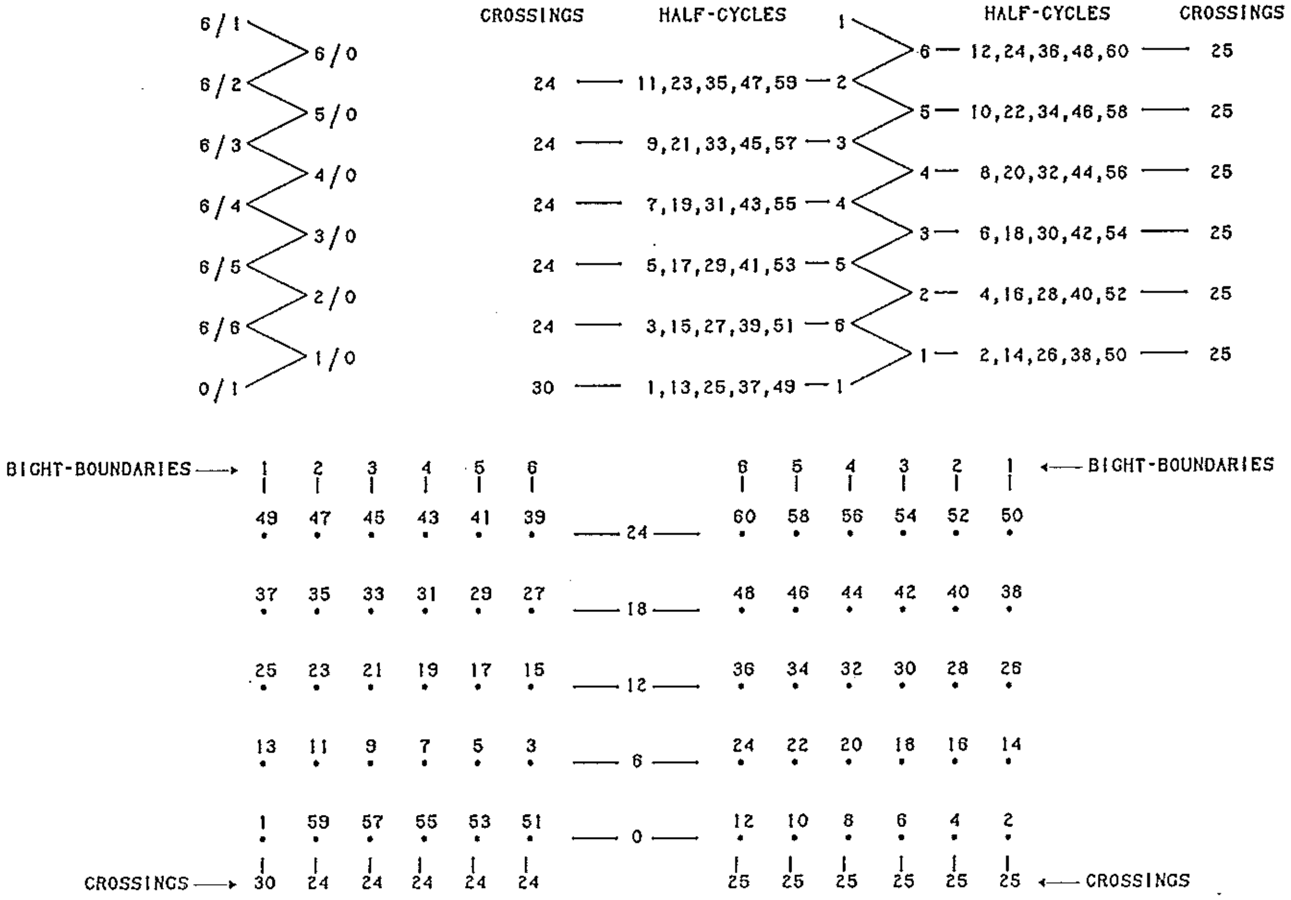


Fig. 1184 — First-return string-run and half-cycle pattern of the single string spherical Regular Nested Knot with $A = 6$, $B^* = 5$, $x = 21$, $k = 1$.

51. 6 ↗ 2: 3u − 3o − 3u − 2o − 3u − 3o − 3u − o − u − o − u .
52. 2 ↖ 5: o − u − o − u − 3o − 3u − 3o − 2u − 3o − 3u − 3o − u .
53. 5 ↗ 3: o − 3u − 3o − 3u − 2o − 3u − 3o − 3u − o − u − o .
54. 3 ↖ 4: u − o − u − 3o − 3u − 3o − 2u − 3o − 3u − 3o − u − o .
55. 4 ↗ 4: u − o − 3u − 3o − 3u − 2o − 3u − 3o − 3u − o − u .
56. 4 ↖ 3: o − u − 3o − 3u − 3o − 2u − 3o − 3u − 3o − u − o − u .
57. 3 ↗ 5: o − u − o − 3u − 3o − 3u − 2o − 3u − 3o − 3u − o .
58. 5 ↖ 2: u − 3o − 3u − 3o − 2u − 3o − 3u − 3o − u − o − u − o .
59. 2 ↗ 6: u − o − u − o − 3u − 3o − 3u − 2o − 3u − 3o − 3u .
60. 6 ↖ 1: 3o − 3u − 3o − 2u − 3o − 3u − 3o − u − o − u − o − u .

After the foundation knot has been braided and properly tightened, we replace its string with a longer string which incorporates in its odd half-cycles associated with the grid-diagrams in Fig. 1186 the star knot elements as in Figs. 1165, 1167, 1169 or as in Figs. 1171, 1173, 1175.

L → R

	59	57	55	53	51	13	11	9	7	5	3	25	23	21	19	17	15	37	35	33	31	29	27	49	47	45	43	41	39					
49	47	45	43	41	39		59	57	55	53	51	13	11	9	7	5	3	25	23	21	19	17	15	37	35	33	31	29	27					
37	35	33	31	29	27	49	47	45	43	41	39		59	57	55	53	51	13	11	9	7	5	3	25	23	21	19	17	15					
25	23	21	19	17	15	37	35	33	31	29	27	49	47	45	43	41	39		59	57	55	53	51	13	11	9	7	5	3					
13	11	9	7	5	3	25	23	21	19	17	15	37	35	33	31	29	27	49	47	45	43	41	39		59	57	55	53	51					
o	u	o	u	o	u	u	u	o	o	o	u	u	u	o	o	u	u	u	o	o	o	u	u	u	o	u	o	u	o	1	13	25	37	49
u	o	u	o	u	u	u	o	o	o	u	u	u	o	o	u	u	u	o	o	o	u	u	u							59	11	23	35	47
o	u	o	u	u	u	o	o	o	u	u	u	o	o	u	u	u	o	o	o	u	u	u	o							57	9	21	33	45
u	o	u	u	u	o	o	o	u	u	u	o	o	u	u	u	o	o	o	u	u	u	o	u							55	7	19	31	43
o	u	u	u	o	o	o	u	u	u	o	o	u	u	u	o	o	o	u	u	u	o	u	o							53	5	17	29	41
u	u	u	o	o	o	u	u	u	o	o	u	u	u	o	o	o	u	u	u	o	u	o	u							51	3	15	27	39

R → L

2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50					
50	52	54	56	58	60	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38					
38	40	42	44	46	48	50	52	54	56	58	60	2	4	6	8	10	12	14	16	18	20	22	24	26					
26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	2	4	6	8	10	12	14					
14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	2					
o	o	o	u	u	u	o	o	o	u	u	o	o	o	u	u	u	o	o	o	u	o	u	o	u	12	24	36	48	60
u	o	o	o	u	u	u	o	o	o	u	u	o	o	o	u	u	u	o	o	o	u	o	u	o	10	22	34	46	58
o	u	o	o	o	u	u	u	o	o	o	u	u	o	o	o	u	u	u	o	o	o	u	o	u	8	20	32	44	56
u	o	u	o	o	o	u	u	u	o	o	o	u	u	o	o	o	u	u	u	o	o	o	u	o	6	18	30	42	54
o	u	o	u	o	o	o	u	u	u	o	o	o	u	u	o	o	o	u	u	u	o	o	o	u	4	16	28	40	52
u	o	u	o	u	o	o	o	u	u	u	o	o	o	u	u	o	o	o	u	u	u	o	o	o	2	14	26	38	50

Fig. 1185 — The half-cycle tables of the single string spherical Regular Nested Knot in Fig. 1183 with $A = 6$, $B^* = 5$, $x = 21$, $k = 1$.

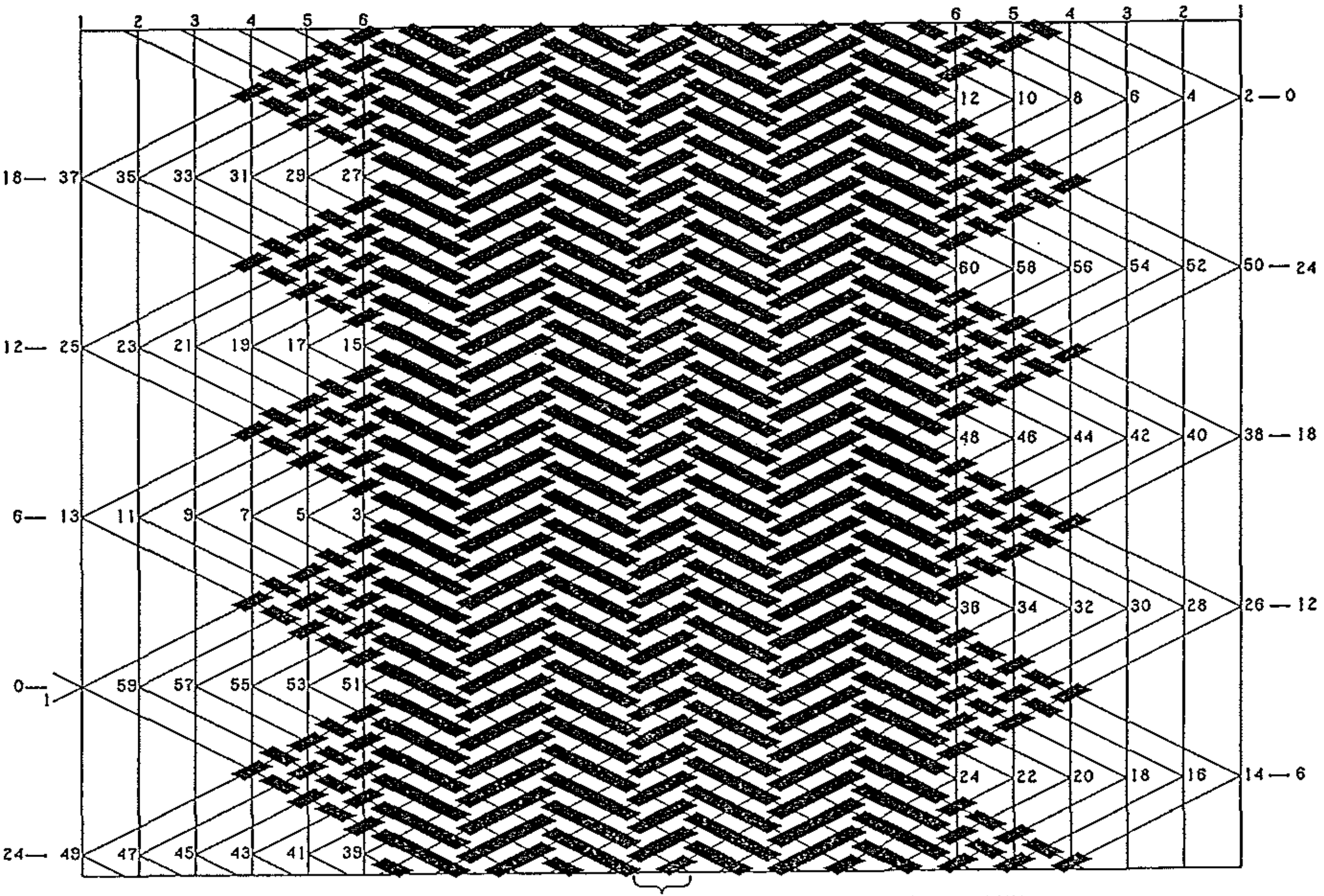
Similar as in Example 1, the star knot elements occupy the position of the dotted line segments in the odd-numbered half-cycles. The solid line segments in the even-numbered half-cycles in these positions follow the coding of the foundation knot.

When we mirror (hence laterally inverse or sideways reverse) the coding and the string-run in Fig. 1183, followed by replacing this string-run with a string-run in which the first cycle, running from lower-left bight-boundary 1 to upper-right bight-boundary A, then from lower-right bight-boundary A to upper-left bight-boundary 2 (hence a string-run with $k = A$), the even-numbered half-cycles in this thus resulting grid-diagram are then sequentially adjacent.[†]

In the now central 2-overs column on the even-numbered half-cycles we replace the local solid string-run line-segments with dotted string-run line-segments.

After the foundation knot has been braided and properly tightened, we replace its string with a longer string which incorporates in its even-numbered half-cycles, at the dotted line-segments, the star knot elements as in Figs. 1166, 1168, 1170 or as in Figs. 1172, 1174, 1176.

[†] Refer to *The Braider*, pg. 1428.



REPLACE CENTRAL 2-OVER COLUMN-CODING FROM LOWER-LEFT TO UPPER-RIGHT WITH STAR-KNOT CODING.

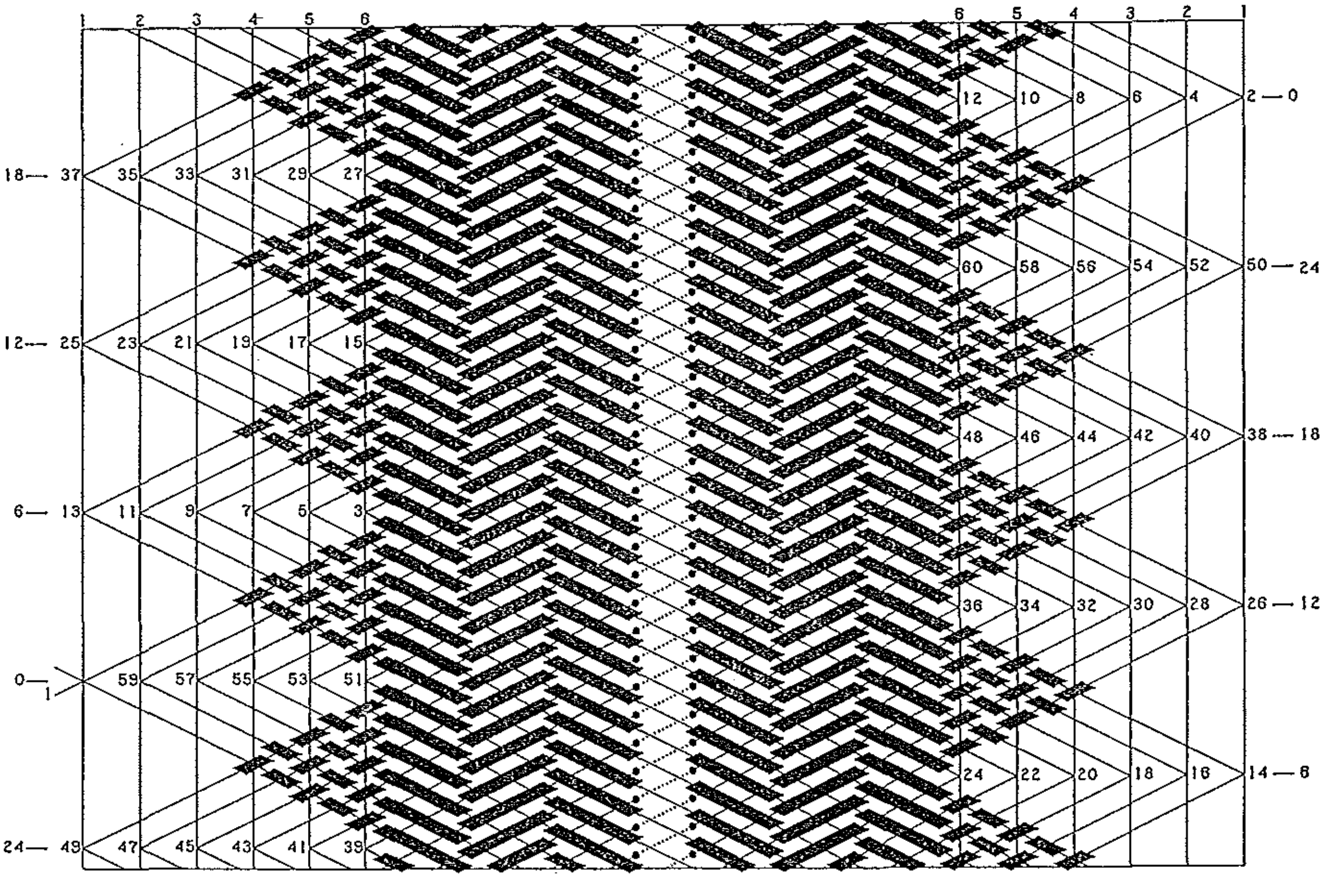


Fig. 1186 — The grid-diagram of the Saturn Knot in Example 2.

THE BRAIDER

No.60 **NOVEMBER 2009.**

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pg.

The A set of Mongolian Hobbles 1435

A quarterly publication
for
the braiding artisan

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A Set of Mongolian Hobbles.

Introduction.

In a letter, of February the 18^{th} 2003, Doug Van Tassel wrote:

It was interesting that a braid originating from a folded strap was in the Appendix for 2002. The enclosed article contains such a braid, although in this case it necessitates a different method as you will see.

A fellow that I know ranches with his brother up close to the Wyoming line. He does some braiding; very many whips and mostly uses a nylon cord. He does a fair job of braiding and very seldom ever changes methods that he has been using in the past. He did one day this winter cross path with a Mongolian herder that was trailing a bunch of cattle across country. The few Mongolians around here come for the same work as the South Americans do which is ranch work. They can all work in the U.S. for three years then have to go home for a year before they can come back. This Mongolian evidently spoke a limited English but enough to carry on a broken conversation.

He brought to the States all the rawhide equipment with him. It is similar to much of the South American tack that is used in every day work in that it is constructed from heavy rawhide. What it lacks in appearance it will easily make up for in durability. Among his equipment was a set of hobbles meant to bind three legs. The two front feet and one hind foot were hobbled together. I have not seen or heard of anything similar to these and what the purpose of hobbling three feet is I do not know. They are evidently a common piece of equipment in Mongolia. Whether these are used as every day hobbles on any horse or maybe used only on young horses for breaking or whatever was not made clear. Much of these hobbles is made of heavy rawhide strap, some folded and some not and a section of braid. These hobbles are detailed in the article.

He also had a rawhide rope meant for everyday use which was for almost its entire length simply folded in half. This does not right off seem like an easy rope to handle, but evidently he was quite adept in its use. Only on the honda end did the strap go into a 4-string round braid for a length of about 6 ft. and the honda fashioned on the end of this. The transition from a folded strap to 4-string round braid is drawn in Fig. 1199. The rope honda was then made in the same manner as the hind cuff closure on the hobbles.

A rawhide headstall and reins were not as easily parted with for a few of days as the rope and hobbles were, so I did not have a chance to examine their construction. I did see a photo of them, but it was not clear enough to get any details. He evidently was a very pleasant fellow so possibly come spring he will for a few days be in the same area again and I can get a look at some of the other items.

The Set of Mongolian Hobbles.

Recently the opportunity arose to examine a set of hobbles made by a Mongolian herder. These hobbles are unusual in that they are meant to bind a horses two front feet with one hind foot. We do not claim to possess any reason or wisdom as to why a set of three-legged hobbles would be needed or used, but since they are evidently not at all uncommon in Mongolia we would assume, then, that they have their purpose in everyday or occasonal usage. The hobbles are made from softened, unsplit rawhide and show a considerable amount of usage. They do, however, remain in excellent condition.

What they may lack in appearance, they make up for in durability. While many braiders might dismiss these hobbles as being too course for their own taste, they do, however, employ a few techniques that might be of interest. The entire construction process is detailed and the dimensions of the original hobbles are given. It is not known what size of horse these may have been used on, so all dimensions given can be considered suspect.

The hobbles are constructed from a total of 8 individual pieces as shown in Fig. 1187. There are two front cuff straps which are labeled 'a'. There is one hind cuff strap which is labeled 'b'. All three of these straps are about $1\frac{1}{4}''$ wide. These three straps are brought together and tied into a three-way union labeled 'c'. In the vicinity of 'c', each of the three cuff straps will have been folded in half, as shown later, and these folded sections are tied into knot 'c'. The two ends of strap 'b' will be cut into a total of four strings which will go into a length of 4-string round braid, also detailed later. There will be a closure strap labeled 'd' for each of the front cuffs, each being about $\frac{5}{8}''$ in width. And finally, there will be three hardwood pins labeled 'e', one each for the three cuffs.

The three-way union knot 'c' is made with a simple crowning operation. This knot can be done in a couple of ways as will be shown, but the method used on the hobbles is the best. Keeping in mind that the cuff straps 'a' and 'b' will be folded in half within the knot 'c', these three straps can be initially laid out and crossed as shown in Fig. 1188 where they are labeled simply as straps 1, 2 and 3. Using the ends of these straps that have last gone **under** an adjoining strap we can crown them as shown in Fig. 1189. Here strap 1 has been laid across to the left; then strap 2 is laid downwards **over** strap 1; then strap 3 is laid upwards **over** strap 2 and **under** strap 1.

We could also use the initial crossings as shown in Fig. 1190 which is the mirror-image of Fig. 1188. Again, using the ends of these sraps that have last gone **under** an adjoining strap, we can crown them as shown in Fig. 1191. here strap 1 has been laid across to the right; then strap 2 is laid downwards **over** strap 1; then strap 3 is laid upwards **over** strap 2 and **under** strap 1.

It can be noted that when these crowning operations have been completed, that were the knot from Fig. 1191 be turned over that its underside will be identical to Fig. 1189. While the initial crossings shown in Fig. 1188 and Fig. 1190 are mirror-images of one another their respective crowning operations will produce the same knot, only turned over. These two knots do not hold their form very well and thus are not highly suited to this application.

We can return to the initial crossings as shown in Fig. 1192 which is identical to Fig. 1188. This time, however, we will re-label the straps and crown in the opposite direction. Again, using the ends of these straps that have last gone **under** an adjoining strap we can crown them as shown in Fig. 1193. Strap 1 is laid across to the left; then strap 2 is laid upwards **over** strap 1; then strap 3 is laid downwards **over** strap 2 and **under** strap 1.

We could also use the initial crossings as shown in Fig. 1194 which is identical to Fig. 1190. With the straps re-labeled we can crown these in the opposite direction, again using those ends of the straps that have last gone **under** an adjoining strap. In Fig. 1195, strap 1 is laid across to the right; then strap 2 is laid upwards and **over** strap 1; then strap 3 is laid downwards **over** strap 2 and **under** strap 1.

It can be noted that Fig. 1192 and Fig. 1194 are mirror-images of each other and that their respective crowning operations will also produce mirror-image results. Hence, the knots in Fig. 1193 and Fig. 1195 are not the same knot but are each other mirror-image. It is the knot in Fig. 1193 that was used in the Mongolian hobbles as the three-way union knot 'c' of Fig. 1187.

There does not appear to be any mention of these three-way union knots, when used as such, in either of the large books of knots. In the 'Encyclopedia of Knots and Fancy Rope Work' by Raoul Graumont and John Hensel these knots are treated as decorative knots. In principle they appear on page 104 in Figs. 363-A and B and on page 297 in Fig. 163 and referred to as *Two-Leaf Dragonfly Knots.* In each case the bights formed in the photographs would need to be cut and the results would be identical to Fig. 1191 and Fig. 1189 respectively of this article. On page 634 in Fig. 1190 and Fig. 1191 is 'A *Two-Leaf Ornamental Knot* based on the Two-Leaf Dragonfly'. If the two extending bights of this knot were cut we would get an asymmetrical knot with little value when employed as a three-way union knot. If, however, we were to leave bfall but one crossing identical to those shown, and the only **exception** would be to make the string-end hanging down on the right go **under** the string-end hanging down on the left. If this were to be done and the extending bights are cut, then we would obtain an identical knot to that tied in Fig. 1193 of this article.

In 'The Ashley Book of Knots' by Clifford W. Ashley on page 200 in Fig. 1102 and on page 392 in Fig. 2448 are knots referred to as 'based on the Chinese Crown Knot' and called a BUTTERFLY KNOT respectively. In each case if the bights are cut we would get knots identical to Fig. 1191 of this article. On page 91 in Fig. 554 is 'A decorative Terminal Knot ---' where we need to ignore the arrow-line entirely, and on page 200 in Fig. 1103 is a knot 'similar in appearance' to one 'based on the CHINESE CROWN KNOT'. In each of these cases, if we cut the extending bights, we would get a knot identical to Fig. 1193 of this article.

In Fig. 1196 is shown the construction of the two front cuff straps, 'a' in Fig. 1187. The lower part is folded in half, flesh-side to flesh-side to be half-width and this will tie into the three-way union knot 'c'. The upper part is the full width of the strap and forms the cuff. The strap is routed as shown and will form a four-layer bundle to be bound together with the closure strap. A slit is cut through the centre of each layer of the bundle. The closure strap makes a single warp around the bundle, then each end is taken through the slits in the four layers. The ends of the closure strap will exit the bundle on the cuff side, one to each side of the single warp. The bundle is cinched down tight with the closure strap. The two ends are then slit-braided together as shown. The two layers of the cuff will be formed and remain tightly together when made of rawhide. At the end of the two-layer cuff, two slits are cut about $\frac{1}{8}''$ apart and $1''$ long in the middle of the cuff strap. No strap material is removed, but rather the $\frac{1}{8}''$ wide strap is pushed between the two layers. A $2\frac{1}{4}''$ long hardwood pin is inserted between the two layers of cuff with the $\frac{1}{8}''$ wide strip fitting tightly into the notch cut in the hardwood pin, thereby holding the pin in its place. The cuffs are closed by putting the loop formed below the slit-braid in the closure strap around the extended ends of the pin.

Some dimensions of the front cuff pieces in Fig. 1196 are as follows: from the end of the folded loop to the centre of the slit in the bundle is about $4\frac{1}{2}''$ on one front piece and about $5\frac{1}{2}''$ on the other front piece. From the centre of the slit in the bundle to the end of the two-layer cuff at the notch is about $7''$. The loop in the closure strap is about $4''$ measured from where an end of the closure strap exits the bundle to the beginning of the slit-braid.

Fig. 1197 begins the construction of the hind cuff strap, 'b' in Fig. 1187. At the bottom, this strap is folded in half, flesh-side to flesh-side, to be half-width for a short distance. This folded section is used to tie into the three-way union knot. Immediately outside of the knot the two ends of the strap are cut into a total of four strands, each about $\frac{5}{8}''$ wide. One end will be cut into two completely separate strands for its entire length, while the other end will be cut into two strands using a long, terminating slit as shown at the top of Fig. 1197. These strands are braided into a 4-string round braid for a length of approximately $23''$ and ending with the final crossing shown with two strands marked **1** and **2**. Note that for this braid to be accomplished, the two strands formed by the long, terminating slit must follow side by side in the same helix.

Fig. 1198 shows the completion of the hind cuff. The strap end that had the long, terminating slit, continues on as shown to form a two-layer cuff, and finally ends after making a bundle back at the end of the braid. A slit is cut through the middle of this bundle. The strand ends marked **1** and **2** are used to form the closure. Strand **1** merely passes through the slit in the bundle. Strand **2** makes a single wrap around the bundle and the cuff strap at the end of the braid. It then goes through the end of the long, terminating slit then through the slit in the bundle. It will exit the bundle on the opposite side of the single wrap as strand **1** and the bundle and cuff strap cinched tightly together. Strand **1** and strand **2** will then be slit-braided together and the closure completed by installing the hardwood pin in the same fashion as detailed in Fig. 1196.

In Fig. 1198 the length from the end of the long, terminating slit to the end of the two-layer cuff at the notch is about $8\frac{1}{2}''$. The loop in the closure is $3\frac{1}{2}''$, measured from where a closure strand exits the bundle to the beginning of the slit-braid.

The Mongolian herder also had a rawhide headstall, reins and rope. Only the rawhide rope was examined. This rope was, for nearly its entire length, merely folded in half, flesh-side to flesh-side, to be half-width. Only on the honda end did the rope go into a 4-strand round braid for about a length of about 6 feet. The folded strap was cut into four strands as shown in Fig. 1199, with half the folded strap being cut into two separate strands for their entire length, and the other half being cut into two strands using a long terminating slit. The 4-strand round braid is begun as shown. Note that for this braid to be accomplished, the two strands formed from the strap by the long, terminating slit must follow side by side the same helix. This braid was ended with the same crossings shown in Fig. 1197, and the honda formed in the same manner as the cuff closure in Fig. 1198.

With this article, by Doug Van Tassel, our expedition into the realm of knotting and braiding has come to an end. Hence this edition of *The Braider*, Issue No. 60, will be the last one. Since the article itself does not fill a full issue, it has been decided to print each of the accompanying Figures on a single sided page in order to facilitate the readability of the article. We like to note, as a final observation, that everything in the universe has been born to die and hence so has *The Braider*. Our expedition has been of interest to a very small number of people (nearly half the number of fingers on one hand), however, from time to time we did meet the odd hitchhiker and pirate. Finally, I like to thank the two co-authors for their unfading interest and participation. A.G.S.

NOTE

Print the pages 1439 to 1451 single sided.

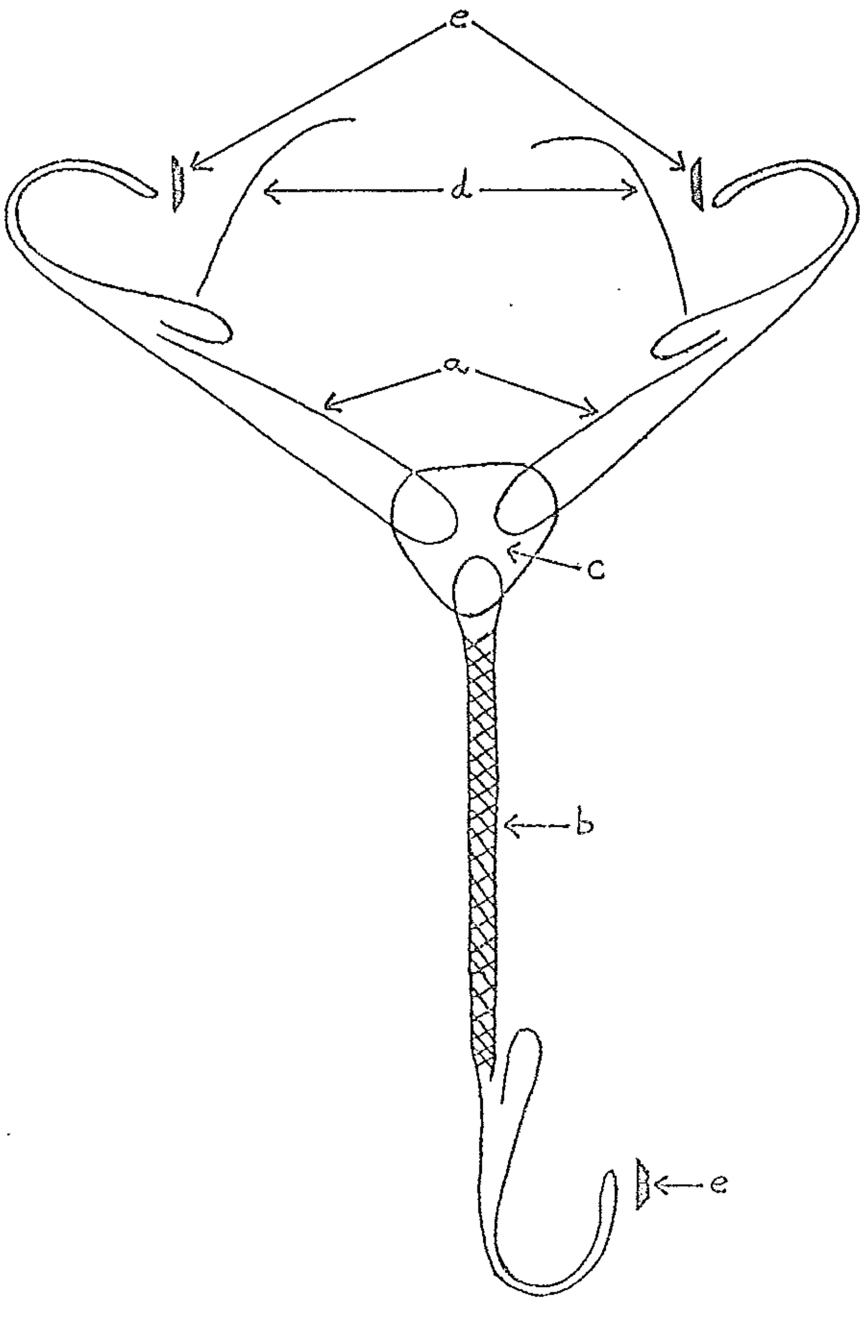

Fig. 1187.

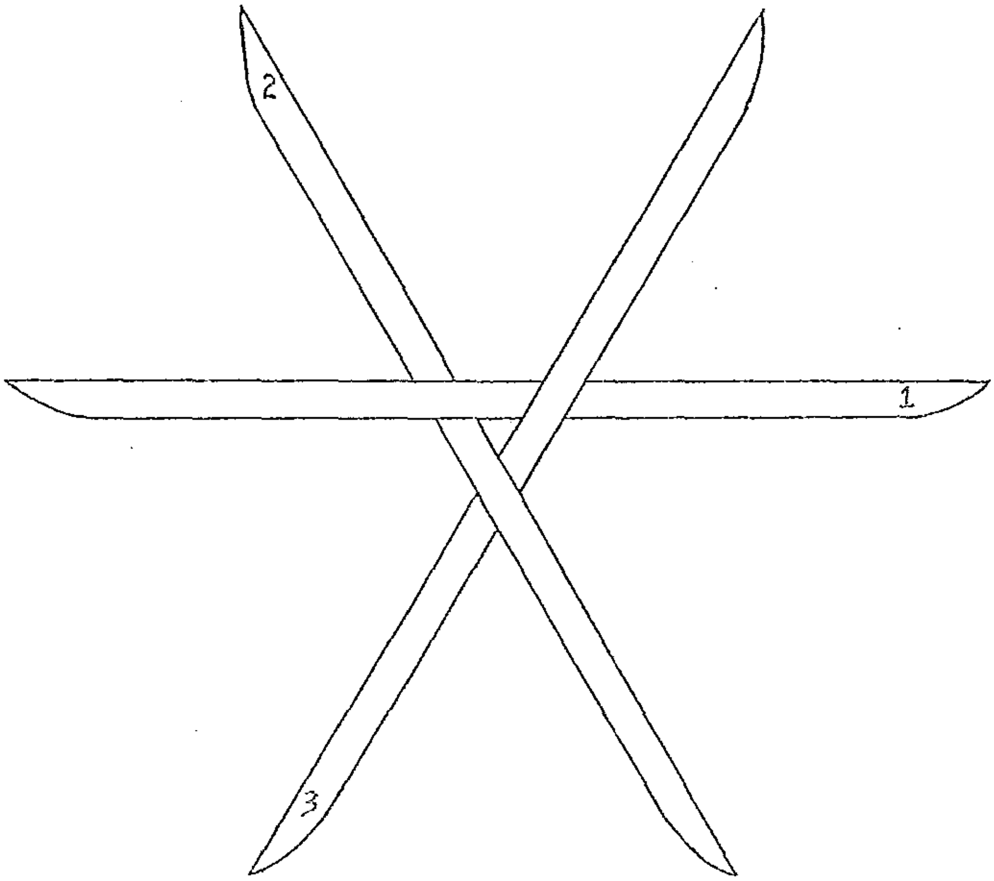

Fig. 1188.

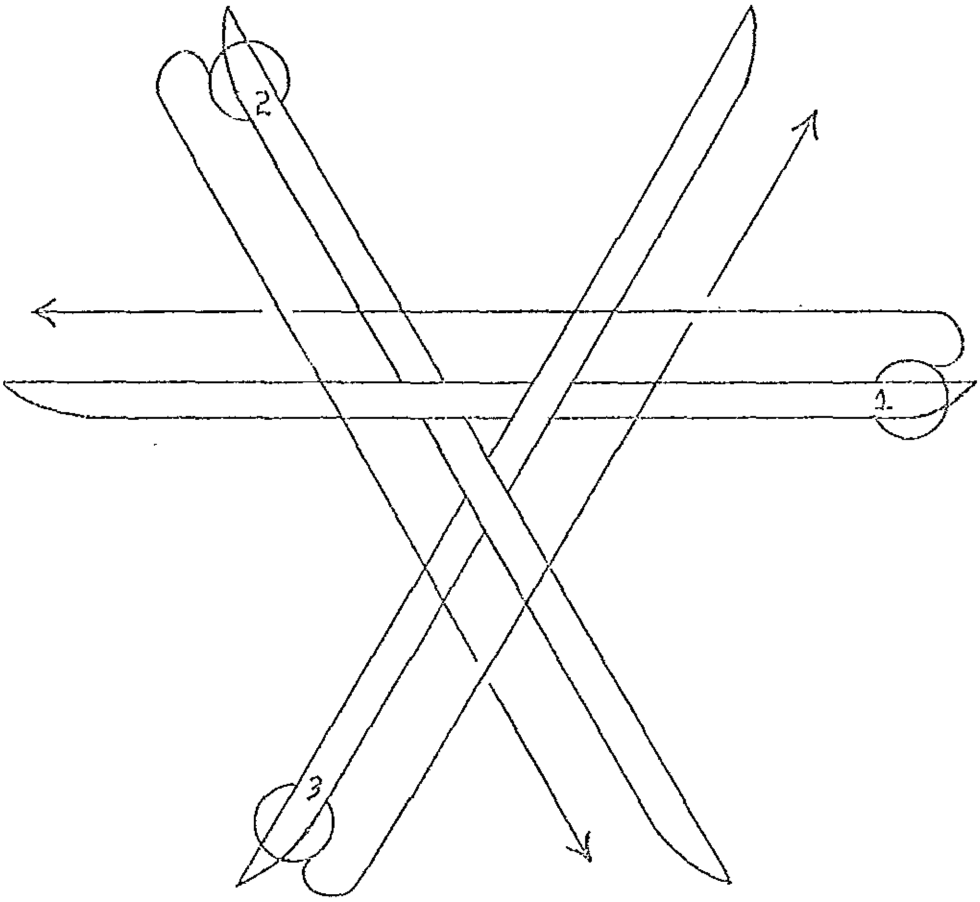

Fig. 1189.

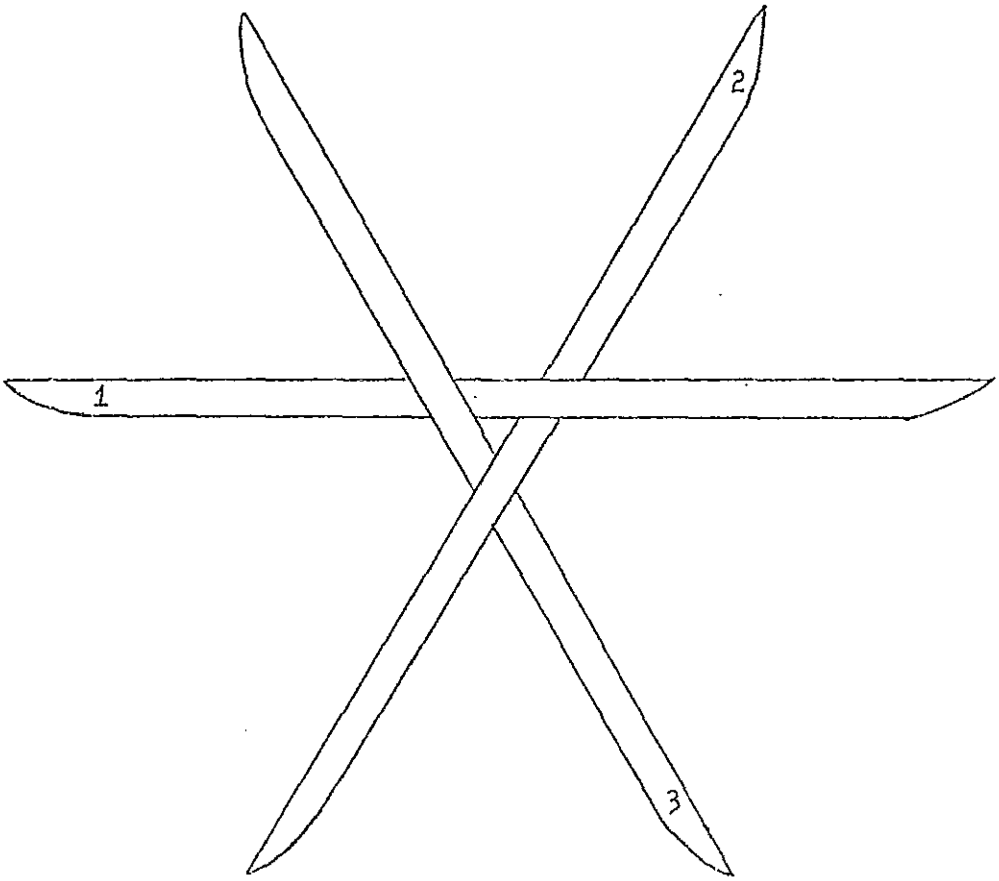

Fig. 1190.

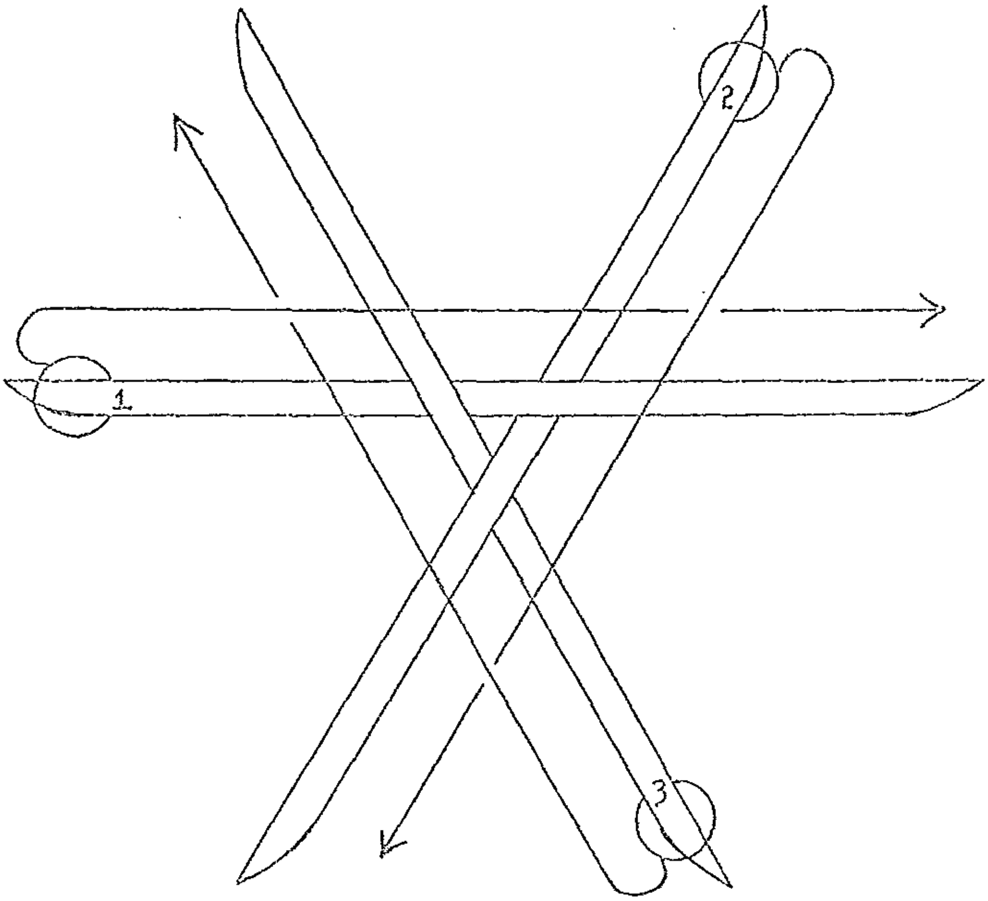

Fig. 1191.

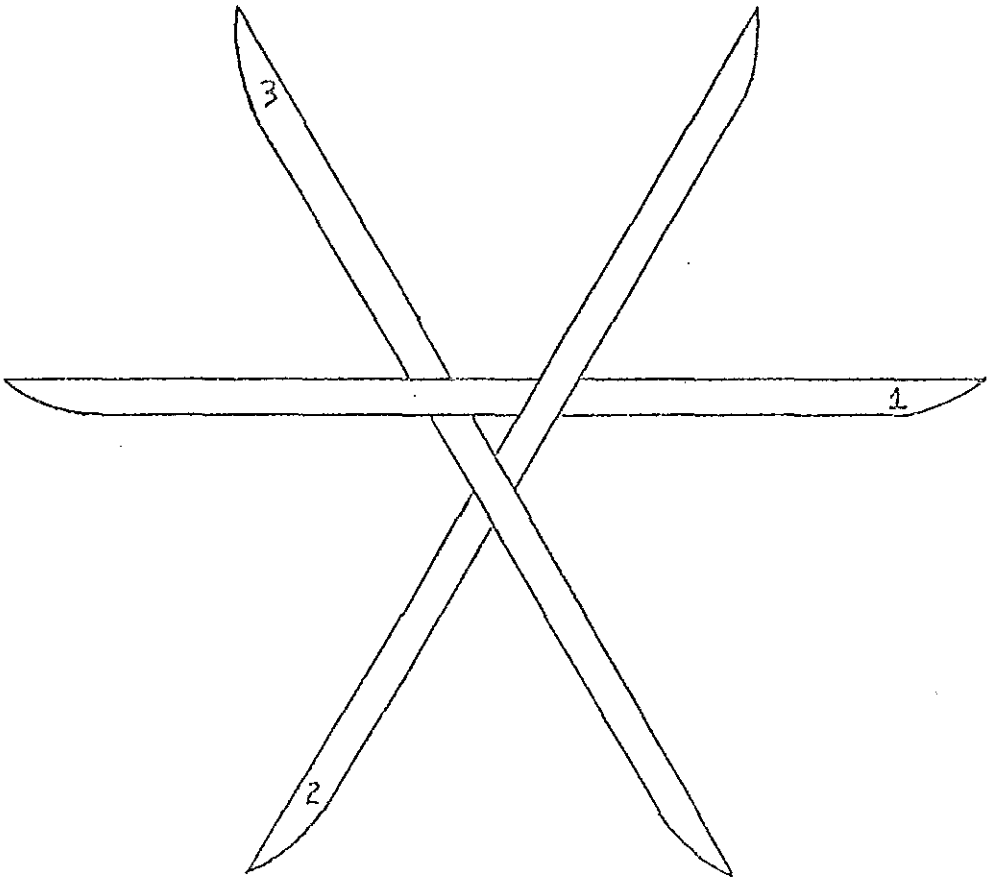

Fig. 1192.

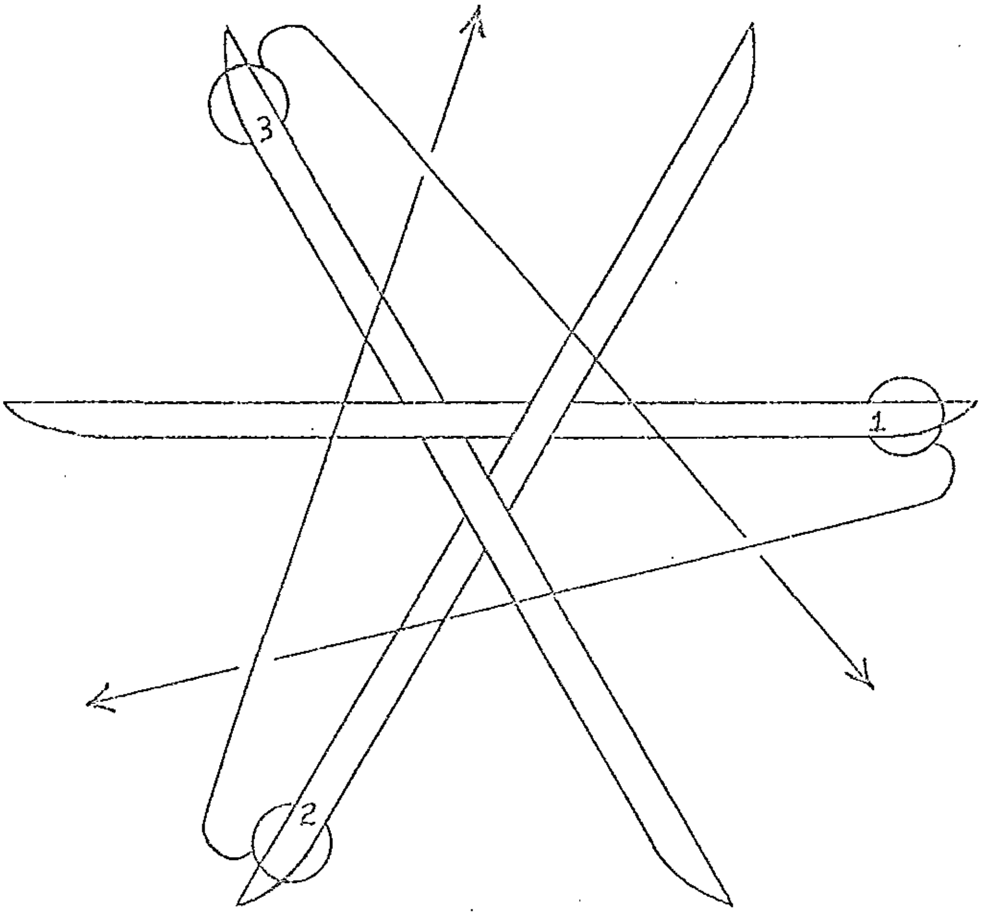

Fig. 1193.

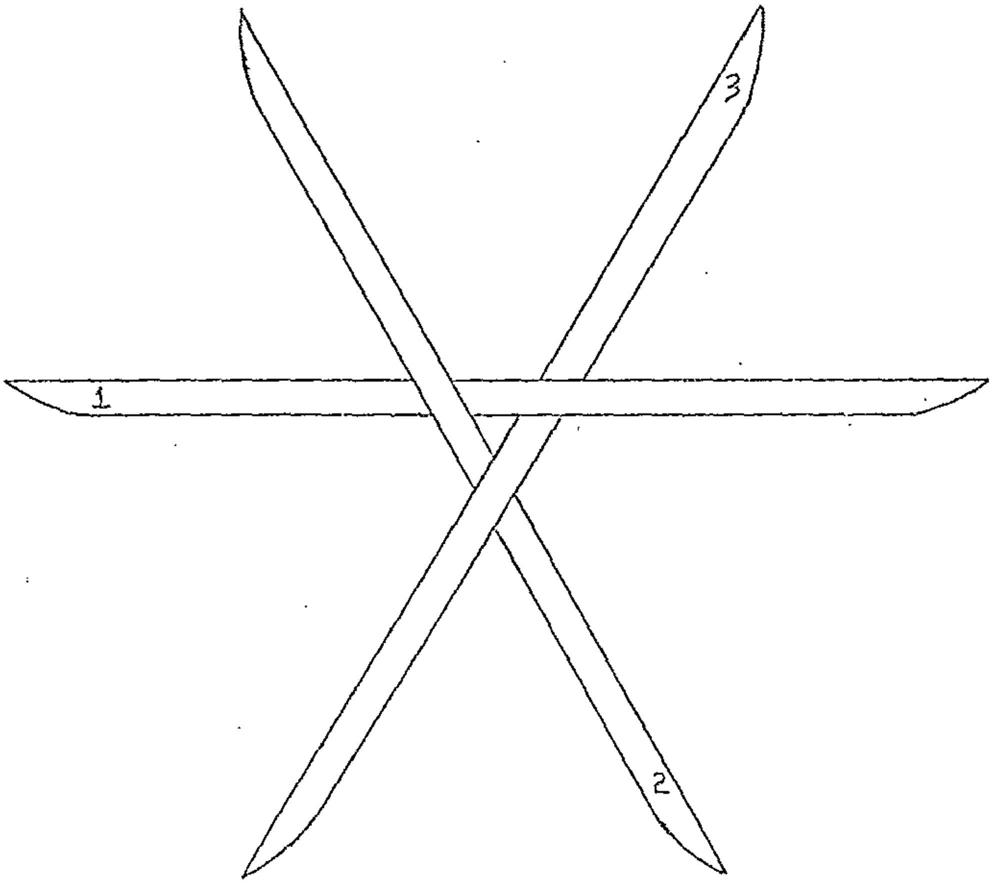

Fig. 1194.

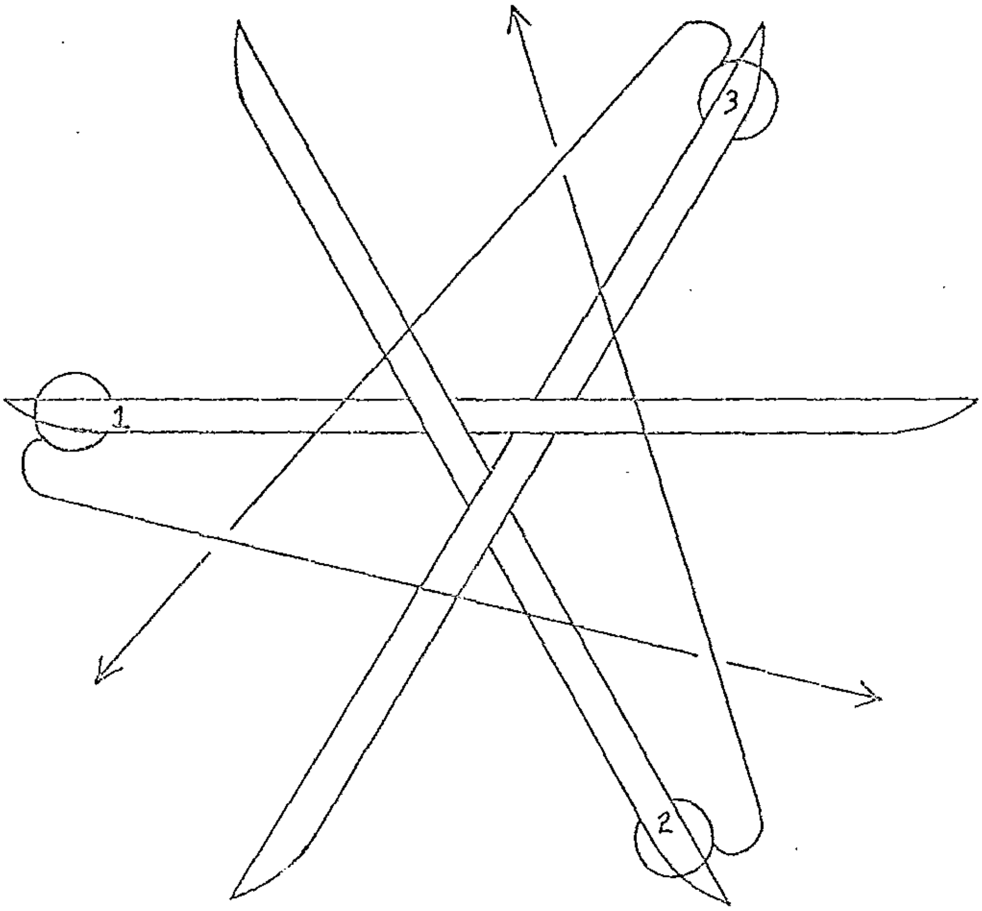

Fig. 1195.

The Braider

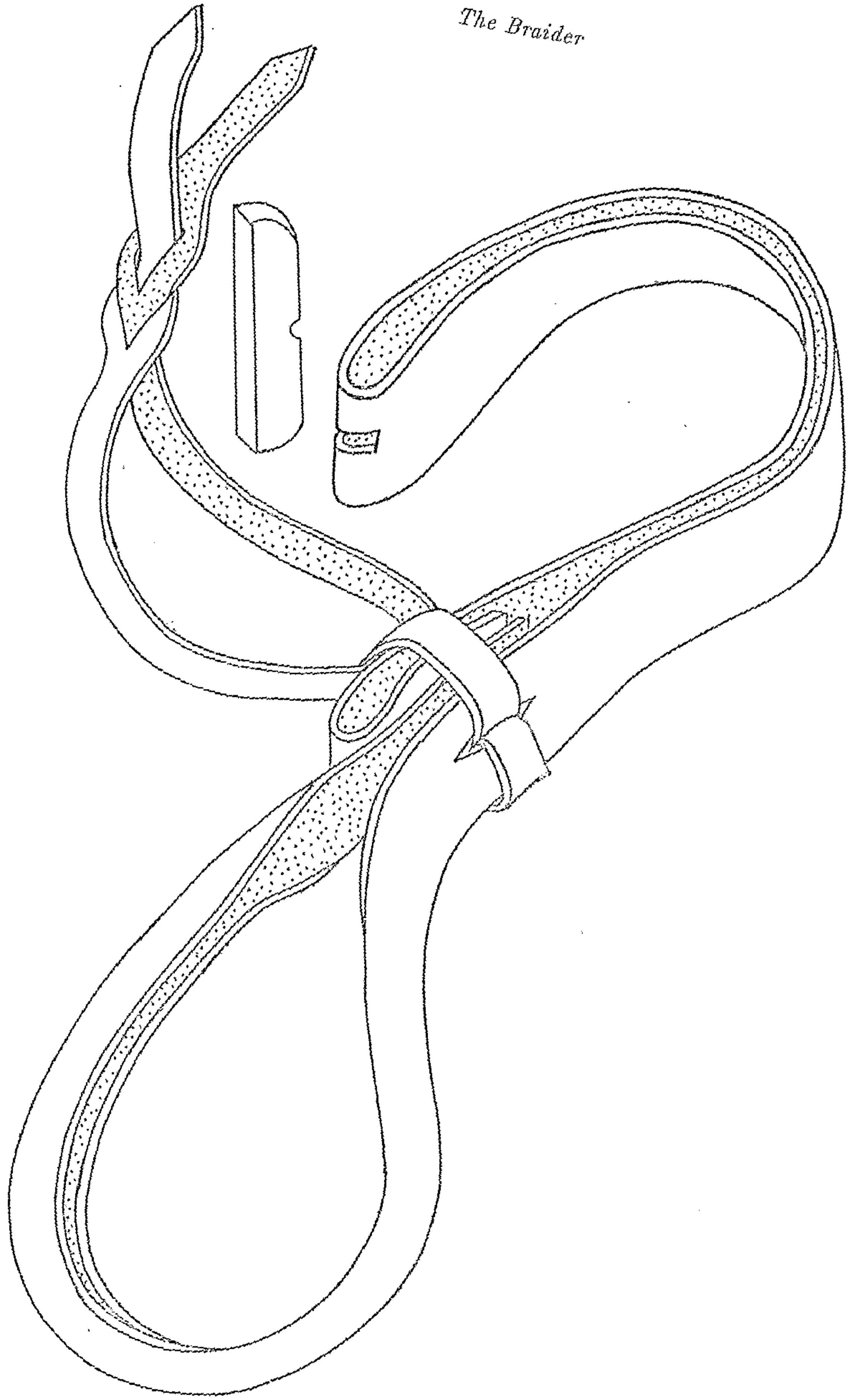

Fig. 1196.

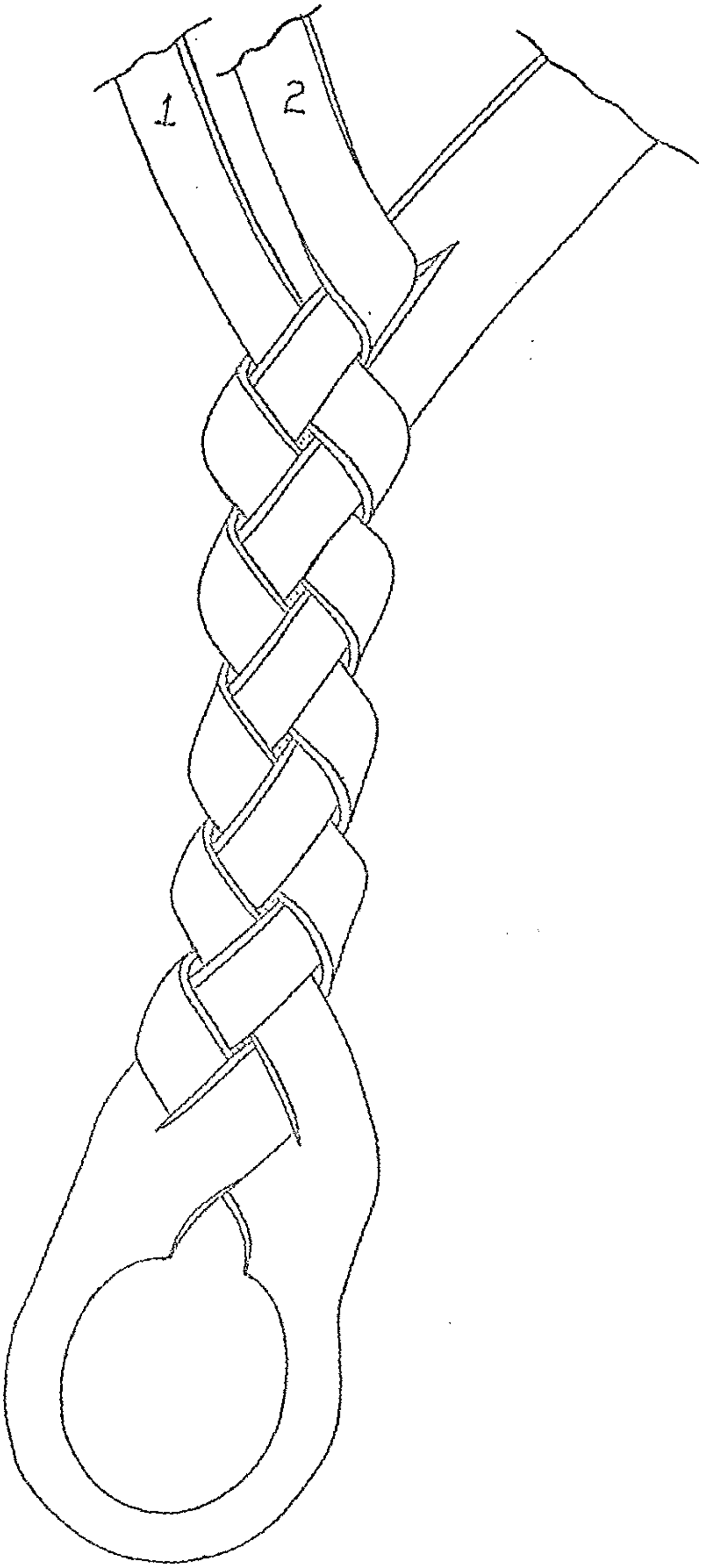

Fig. 1197.

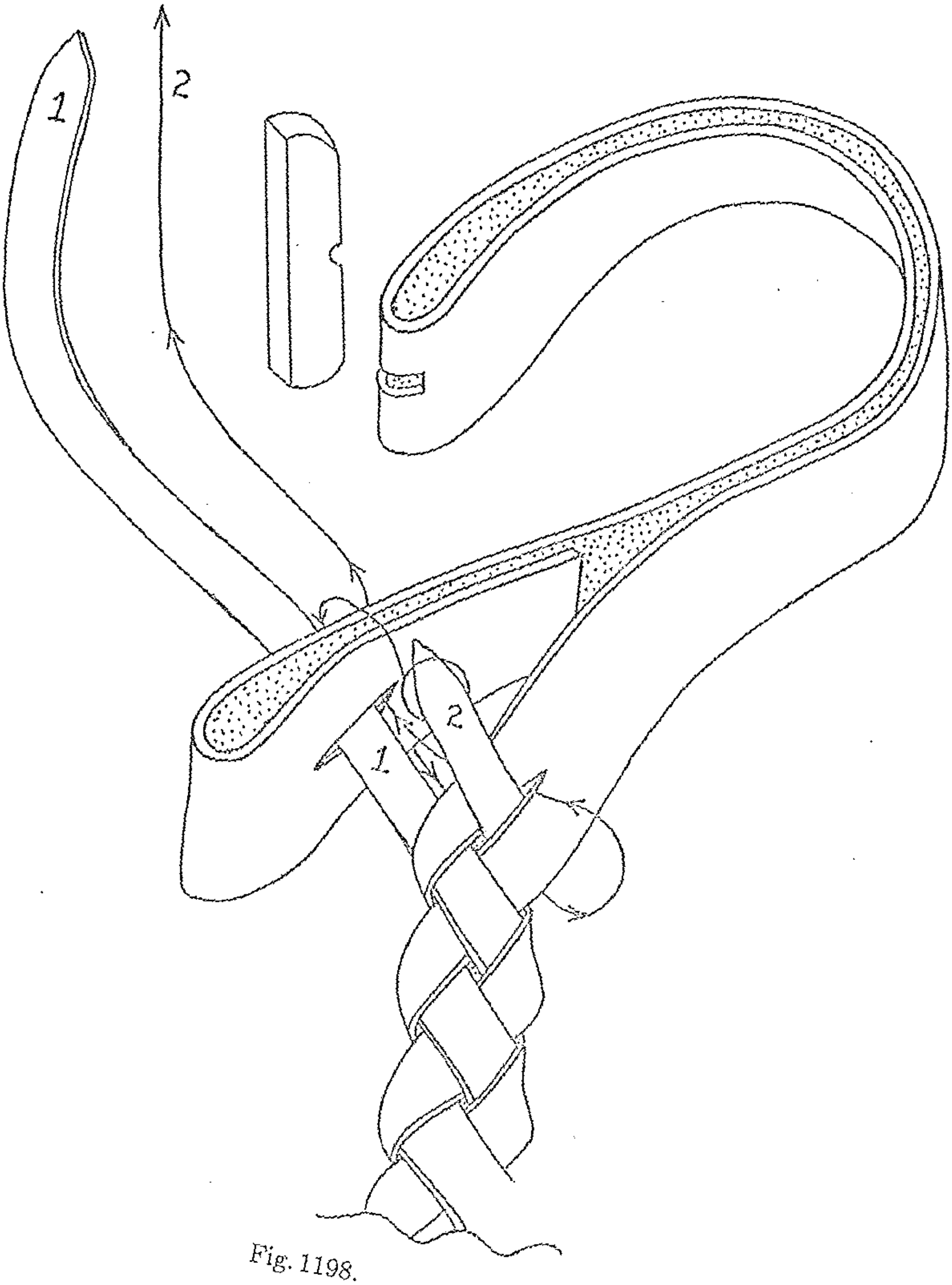

Fig. 1198.

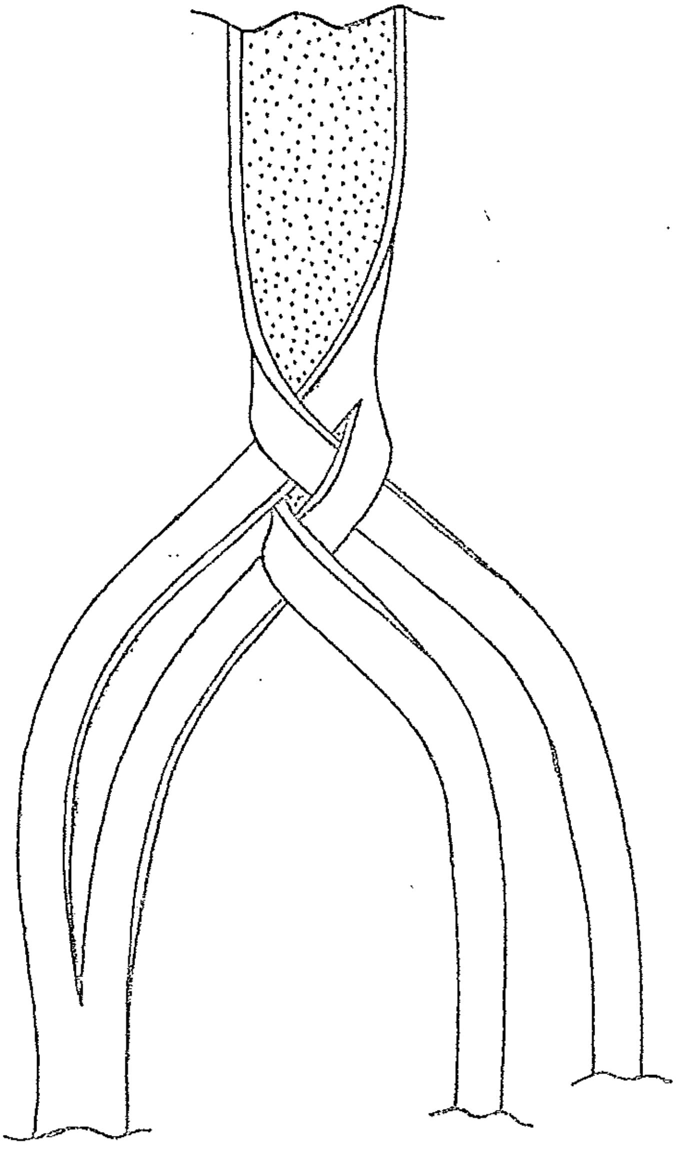

Fig. 1199.

THE BRAIDER

APPENDIX 2009

CONTENTS

pg.

A final note concerning the material dealt with in the sixty Issues of *The Braider* .... *i*

A quarterly publication
for
the braiding artisan

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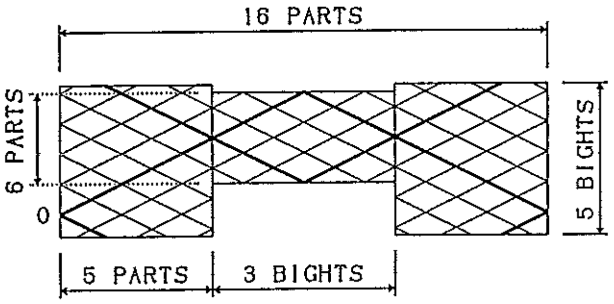
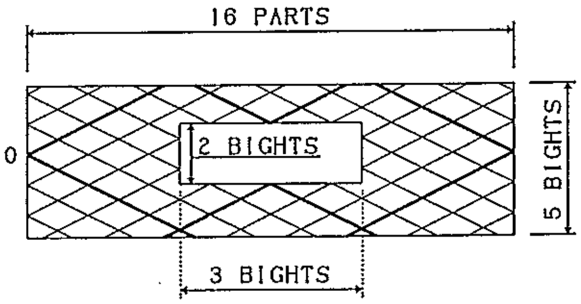
A final note concerning the material dealt with in the sixty Issues of *TheBraider*.

The material dealt with should be regarded as an *introduction* to **braiding**. Hence by no means has any of the topics been treated exhaustively, and neither have we touched all braiding topics. At various instances we might have made some scathing and, to some people, inflammatory remarks about the way braiding topics have been and still are being dealt with. Although these remarks are more than justified, especially there where it concerns people who are supposed to be knowledgeable in their field. A typical case is illustrated by the following episode: In the latter half of 1994 we submitted to *The Fibonacci Quarterly*, the offical publication of the Fibonacci Association, an article entitled *On sequences of compound braids — some properties and problems* for publication in the proceedings of the *Sixth International Conference on Fibonacci Numbers and Their Applications.* Such submissions are subsequently send by the editor of the association to a referee. The referee concerned was no doubt supposed to be a professional mathematician, however, one of the most staggering statements he/she made was: *In essence, the paper describes a family of complicated diagrams (see Figure page 3) parametrized by 4 variables and asks about properties of these diagrams.* See the diagrams concerned below.



Grid-Diagram for a CFC^**-Braid*
(showing one string-polygon only)



Equivalent CWH^**-Braid*
(parameters (H, V,X,B))

There was of course a full explanation of these very simple diagrams given, hence the statement *a family of complicated diagrams* clearly demonstrates that the referee is certainly not much of a mathematician and certainly not anywhere near a real professional accademic one.

The purpose of those scathing and to some people inflammatory remarks referred to above should, however, be seen to stress the utmost importance in the necessity of correcting false and misleading concepts, and are certainly **not** meant to offend anyone, but rather to awaken those living in dreamland. The mathematics encountered, although of a very basic and hence fundamental nature, is an indispensable tool in many of the topics discussed. We hope that we have been able to show the importance of **meaningful** string-run diagrams which are the geometric frameworks (hence mathematical frameworks) of the braids which contain most of the answers one is looking for.

CFC BRAIDS and CWH BRAIDS.

SPECIAL BRAID FORMS Pt.2

CWH KNOTS

Say it is known that the Regular CWH* Knot with $B = 15$, $P = 10$, $b_v = 3$, $b_h = 4$ requires two strings.

Why are we then able to tell, **without making a string-run diagram**, that the Regular CWH* Knot with $B = 21$, $P = 16$, $b_v = 3$, $b_h = 4$ also requires two strings?

CWH KNOTS

The Complemental Law

A Regular CWH Knot with B , p_1 , p_2 , b_v , b_h .

$$p_F = 2B - 2b_v \,,$$
$$P^* = 2b_h \,,$$
$$P = p_1 + p_2 + 2b_h \,.$$

The Complementary Regular CWH′ Knot with B , ${p_1}'$, ${p_2}'$, b_v , ${b_h}'$.

$$\begin{aligned} {p_1}' &= B - p_1 \,, \\ {p_2}' &= B - p_2 \,, \\ {b_h}' &= B - b_v - b_h \,, \\ P^{*\prime} &= 2{b_h}' \,, \\ P' &= {p_1}' + {p_2}' + 2{b_h}' = 4B - 2b_v - P \,. \end{aligned}$$

Examine the Complementary Regular CWH′ Knot for which ${b_h}' = b_h$:

1. ${b_h}' = B - b_v - b_h$.
Then $B - b_v - b_h = b_h$. Hence:
$$B = b_v + 2b_h \,,$$
$$P' = 2b_v + 8b_h - P \,.$$

2. ${b_h}' = 2B - 2b_v - b_h$.
Then $2B - 2b_v - b_h = b_h$. Hence:
$$B = b_v + b_h \,,$$
$$P' = 2b_v + 6b_h - P \,.$$

3. ${b_h}' = 3B - 3b_v - b_h$.
Then $3B - 3b_v - b_h = b_h$. Hence:
$$B = b_v + \tfrac{2}{3}b_h \,,$$
$$P' = 2b_v + 5\tfrac{1}{3}b_h - P \,.$$

4. ${b_h}' = 4B - 4b_v - b_h$.
Then $4B - 4b_v - b_h = b_h$. Hence:
$$B = b_v + \tfrac{1}{2}b_h \,,$$
$$P' = 2b_v + 5b_h - P \,.$$

n. ${b_h}' = nB - nb_v - b_h$.
Then $nB - nb_v - b_h = b_h$. Hence:
$$B = b_v + \tfrac{2}{n}b_h \,,$$
$$P' = 2b_v + (4 + \tfrac{4}{n})b_h - P \,.$$

Say it is known that the Regular CWH* Knot with $B = 15$, $P = 10$, $b_v = 3$, $b_h = 4$ requires two strings. Why are we then able to tell that the Regular CWH* Knot with $B = 21$, $P = 16$, $b_v = 3$, $b_h = 4$ also requires two strings?

Solution:

If the Regular CWH* Knot with $B = 15$, $P = 10$, $b_v = 3$, $b_h = 4$ requires two strings, then also the Regular CWH* Knot with $B = 5$, $P = 10$, $b_v = 3$, $b_h = 4$ requires two strings due to **bights-equivalency**.

A complementary knot of this last knot (which then also requires two strings) has the following specifications:

$$\begin{aligned} &B = 5\,, \\ &{b_h}' = n(B - b_v) - b_h = n(5 - 3) - 4\,, \\ &P' = 2B - P + 2b_h + 2{b_h}' = 2B - P + 2n(B - b_v)\,. \end{aligned}$$

For ${b_h}' = b_h$ we obtain $n = 4$. Hence $P' = 2 \cdot 5 - 10 + 2 \cdot 4 \cdot (5 - 3) = 16$. Consequently the Regular CWH* Knot with $B = 21$, $P = 16$, $b_v = 3$, $b_h = 4$ requires two strings due to **bights-equivalency**.

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